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National Petroleum News

News From Oil Industry Everywhere

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Pennsylvania Discount Law Is Held Void

By Telegraph

HARRISBURG, Sept. 7. — Judge Karl E. Richards, of the Dauphin County court, today held invalid that section of the 1937 act of the Pennsylvania legislature prohibiting service station operators from offering cash discounts. The other sections of the law were upheld, including a provision imposing a $1 annual license fee on each gasoline pump.

Judge Richards' decision resulted from the revenue department attempting to revoke the permit of William B. Brown, Amity Hall, for allegedly giving discounts to truckers at his service station. Brown had obtained temporary injunction to allow him to continue operating his station.

The department on the Labor Day week end in 1937 made the attempt to revoke the permit. Brown immediately obtained his injunction and the case has been in the courts since that time.

Brown was joined in his suit by the Sperry & Hutchison Co., Allegheny County, which had been giving trading stamps redeemable in cash for purchases at their station.

Under the terms of the 1937 act all gasoline dealers were prohibited from selling gasoline below the posted price.

Judge Richards gave four reasons for holding that section of the act invalid. They were:

(1) The section deprived the plaintiff of enjoying and defending life and liberty and acquiring and possessing property. This was held to be in violation of Art. 1, Sect. 1, of the state constitution.

(2) It was local and special law regulating trade.

(3) "It abridged the due process" clause of the Federal Constitution.

(4) It impaired the obligations of the contractor entered into by the plaintiff with other licenses.

'HOT' OIL SALE HIT BY ALLRED

N. P. N. News Bureau

TULSA, Sept. 3.—The round figure of 4,000,000 barrels for East Texas "hot" oil confiscated and sold to date was mentioned by Gov. James V. Allred during the week, when the controversy on the subject had spread over a wide front.

However, mention of this large total amount did not excite nearly as much attention as did the 200,000 barrels and better which Attorney General William McCraw sought to have the district court of Travis county declare illegal, confiscate in the name of the state and order sold to the highest bidder.

The case which provoked the barrage of statements and counter-statements was the State of Texas vs. General American Oil Co., an East Texas company which formerly was a refiner

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Alky-Gas Impractical, Chemist Meeting Told

By Telegraph

By ARCH L. FOSTER
N.P.N. Technical Editor

MILWAUKEE, Sept. 7.—Production of power alcohol in sufficiently large quantities to make on a nation-wide scale a 10 to 15 per cent concentrated blend of motor fuel is not yet possible, Burke Jacobs, senior chemist of the U. S. Bureau of Chemistry and Soils told one division of the American Chemical Society meeting here this week with nearly three thousand chemists attending.

Any such diversion of American farm crops, Jacobs added, would result in price increases which would raise alcohol prices to prohibitive levels and would affect food and feed costs.

There has been little indication of a need for replacement of fuels and fuel supply sources, Jacobs indicated. He threw more immediate light on his views by using the expression "whether our petroleum supply lasts ten or twenty years is immaterial. Although chemists attending probably would not agree with Jacobs' time limitation.

Any compromise program for alcohol utilization will be a slow process, Jacobs continued. At present, alcohol will cost more than gasoline and that extra cost must be met. (He did not add what the petroleum chemist was thinking—that the extra cost would have to be met by government subsidy at the expense of the motorist and the nation.)

Use of alcohol motor fuel has been advocated in this country as a farm relief or crop-price raising expedient rather than a conservation measure, and such proposals bring complications into the picture, Jacobs declared.

High prices for farm crops will raise the cost of alcohol and make it impractical as a motor fuel, he said, presenting a mass of data to support his point.

"Agricultural materials should not be substituted in industry at the expense of raw materials now used, nor should such substitution disturb present operations unduly," Jacobs said. "Despite some proposals, an alcohol fuel industry on a large scale could not be brought about for many years, particularly for lack of processing plants," was Jacobs' conclusion.

Most likely source of additional motor fuels is from cracked gases from petroleum, Jacobs believes. A full report on an "alcohol-for-power" survey by the Bureau of Chemistry

Federal Oil Control Seen If Crude Purchasers 'Fail'

By Teletype
N. P. N. News Bureau

WASHINGTON, Sept. 6. — "The oil purchasing companies must realize that they are required in substance to discharge a public duty and obligation, the alternative being that either proration will fail or federal control must be had, or that both will result."

This is the summarization of a memorandum on pipeline proration sent to Charles F. Roeser, president of the Independent Petroleum Assn. of America this week by Russell B. Brown, chief counsel. Brown said in his letter transmitting the memo that it was "submitted to me by one who has given these matters much thought," but I. P. A. A. officials declined to reveal who drafted it.

It was said, however, that the memo was prepared by a "very prominent" figure in the petroleum industry.

Proration, says the memo, "rests upon the fundamental proposition that each producer each day, wherever situated, will receive his ratable share of the day's market . . . but in order to effectuate this, it is necessary to have adequate control of imports, storage withdrawals, fair and equitable allocations among the states, as well as among pools within the states, and ratable takings within pools within the states."

But since neither state commissions nor the compact possess sufficient power to control all these, and since what control they do possess is interpreted by the drafter of the memo as "unsatisfactory or negative", tending only to "drive purchasing power away from the pool, and in many cases out of the state . . .", the memo arrives at the conclusion.

"Therefore, it becomes apparent that proration is something of a paradox — we control production without any public authority which is empowered to see to it that equity and fairness and ratable takings are assured to all concerned, and particularly to those producers who are entirely unable to protect themselves. No conceivable form of state compact can have, nor do state commissions have control over all of the factors involved. Only a

(*Continued on page* 19)

and Soils will be issued in two or three weeks, it is understood.

Preparation of isoparaffins of 90-100 octane number from olefins and isoparaffins by low temperature alkylation with sulfuric acid attracted a large group of petroleum chemists during the Sept. 7 morning session.

A. E. Dunstan and collaborators have developed this process using not only pure Hydrocarbons but fractions of refinery gases, the third group of recent processes for producing super-fuels.

An extra cost of substitute fuels over that of imported petroleum gasoline, amounting to 32 cents per gallon, was reported by Dr. Gustav Egloff, Universal Oil Products Co., following an extended tour of Europe this past summer.

An additional $300,000,000 will be paid by Europe this year for substitute fuels than if they had used petroleum gasoline, Egloff reported.

Use of power alcohol has taken a nose-dive recently from the heights of a year or two ago, Egloff found on his European trip, the drop being 25 per cent in 1937.

Alcohol is being steadily diverted from motor fuel to munitions manufacture, Egloff continued. In France and Italy not enough alcohol has been available to blend with gasoline; Germany has twice reduced the percentage of alcohol required in commercial fuels because of shortage.

Synthetic gasoline by hydrogenation of coal and carbon monoxide is the only product likely to ever become important in the U. S., Egloff said, and then only when our petroleum reserves need supplementary sources, he added.

Canadian Output Triples '37 Figure

OTTAWA, Sept. 6.—Production of crude petroleum in Canada during the first half of 1938 totaled 2,919,425 barrels, or more than in the 12 months of 1937 and three times as much as in the January-June period last year, the Dominion Bureau of Statistics reports.

June production this year totaled 537,654 barrels for the month, of which 516,703 barrels came from the Turner Valley field in Alberta. In 1937, production in June amounted to 209,181 barrels.

Imports of crude and petroleum products into Canada during June were appraised at $6,688,379, as against $6,693,603 in May.

Indiana Standard Is Freed Of Discrimination Charges

DETROIT, Sept. 6.—Charges of price discrimination against Standard Oil Co. of Indiana in the sale of gasoline to retailers in the Detroit area were dismissed in an opinion handed down Sept. 1 by Judge Arthur E. Gordon in Recorders Court here.

This case, a part of Wayne County Prosecutor Duncan C. McCrea's campaign to stabilize retail gasoline prices under the Michigan fair trade law, was a criminal prosecution and accused the Indiana company of selling gasoline at tank car prices to Ned's Auto Supply Co. through the Ned's-owned Merchants Supply Co., while withholding this privilege to other retail dealers in the city.

In the examination, held two weeks ago before Judge Gordon, it was shown that Standard's tank car price was 1.5 cents below the tank wagon price at which gasoline was delivered to retail dealers generally (See N.P.N., Aug. 24).

In the examination testimony, P. A. Raupagh, Detroit manager for the Indiana Standard, stated his company did not differentiate between a wholesaler and a retailer in determining eligibility to receive gasoline at the tank car price.

Requirements Stated

In order for an operator to buy at tank car prices from Standard, Raupagh testified that Standard requires that he shall have an annual volume of between 1,000,000 and 2,000,000 gallons, that he shall have ample credit responsibility and that he shall have the necessary physical equipment to handle tank car shipments.

In handing down his opinion, following the presentation of briefs by both sides, Judge Gordon stated:

"The part of the complaint reciting that Samuel Gershenson, doing business as the Merchants Supply Co., is a retailer and that he sells to himself and others of the Gershenson family, doing business under the name of Ned's Auto Supply Co., may be disregarded as mere surplusage, there being no law called to the attention of the court prohibiting such sale."

Judge Gordon remarked it was necessary to prove the alleged discrimination occurred within Detroit. He also pointed to the testimony of competitive oil company representatives during the examination, who stated their business had not been directly harmed by Standard's policy with the Ned's stores.

Competition Cited

Standard admitted on the witness stand that Ned's was favored with a lower price and supported its stand on the grounds that competitive conditions made this policy necessary. Sam Gershenson, a partner in the Ned's company, had previously testified that, prior to the time the Merchants Supply Co. erected a bulk plant, several oil companies had approached him with offers to sell his company gasoline at tank car prices.

This is the second case brought under the state fair trade law which has been lost by the prosecutor's office. The first case, which charged Stark Hickey, Inc., with selling gasoline below cost, was dismissed on examination some weeks ago by Recorder's Judge Donald Van Zile. At that time the court discounted as "inadequate" the cost survey of dealer operations which the law provides shall be a measuring stick to determine violations.

The Retail Gasoline Dealers Assn. of Mich., which brought the action against Hickey, is now completing a more thorough and all-inclusive cost survey, which is expected to be ready soon for use in further prosecutions under the fair trade law.

Arthur J. Abbott of Detroit, represented Standard in the price discrimination case, and the prosecution was argued by assistant prosecutor Ralph K. Garber.

There have been indications that a third fair trade case would melt under the heat of insufficient evidence. In this case, against the Gorman-Rubens Auto Supply Co. and involving unearned discount allegations, it is reported the Recorders Judge has indicated that stronger evidence is necessary.

Gasoline Pipeline Attacks ICC Value

By Teletype
N. P. N. News Bureau

WASHINGTON, Sept. 7.—Hearing on Great Lakes Pipeline Co.'s 7-point protest against the tentative valuation of $16,400,000 set on its carrier-owned-and-used properties by Interstate Commerce Commission, was held today before ICC Examiner M. A. Pattisen. The Great Lakes line, jointly owned by nine major oil companies, carries gasoline from the mid-continent to Chicago and the Twin Cities.

Pattisen took the protest under advisement, setting October 7th as the date by which the company may file a brief in support of its contentions that the valuation is too low. The Valuation Bureau may file an answer brief within 30 days after the company's brief, after which the examiner will prepare his proposed report on the valuation.

Great Lakes' protest against the tentative valuation was based on the grounds that the Valuation Bureau had erroneously (1) determined present value of lands; (2) determined value of Rights of Way; (3) omitted other property from the valuation; (4) excluded line fill, or operating gasoline supply; (5) determined value of buildings; (6) omitted going concern value and, as a result had; and (7) erroneously determined final value.

The tentative valuation report on Great Lakes was issued last March NATIONAL PETROLEUM NEWS, March 30th, page 19.

Oil Burner Shipments Up

WASHINGTON, Sept. 7.—Shipments of oil burners by American manufacturers in July numbered 10,689, compared with 9550 in June and 16,404 in July 1937, Census Bureau reports.

Plan To Speed Up Detroit Oil Cases

DETROIT, Sept. 7.—That the state may waive examination on three oil company cases now pending before local courts here charging fair trade law violations, was indicated today by Ralph K. Garber, assistant prosecuting attorney for Wayne County.

The three cases originally set for examination to begin next week all charged conspiracy in restraint of trade and unfair price discrimination. The cases are the State vs. the Gulf Refining Co. and B. F. Goodrich Co.; State vs. The Texas Co. and the B. F. Goodrich Co.; and State vs. the Standard Oil Co. of Indiana and Citrin-Kolb Oil Products Co.

Garber indicated today that the prosecution may enter into a "gentlemen's agreement" with the defendants, and, through a stipulation of facts, move the cases directly to the state supreme court for a ruling. This action would eliminate the need for examination, according to Garber.

Illinois Buying Plan Is Based on Spacing

N. P. N. News Bureau

TULSA, Sept. 3. — In announcing its oil purchasing plan for the new Louden pool of Fayette county, Illinois, the Carter Oil Co. revealed an ambition to bring about economic well spacing in the development of the pool.

Its own operations have resulted in the drilling of more than 40 producing wells there to date. It has spaced its wells two to the 40 acres, locating the wells in the center of the diagonal 10-acre tracts in the 40-acre subdivision.

The field, apparently, is one of the best ever found in the state. Present proved extent is about 11 miles north and south and between two and three miles east and west. Carter owns 20 sections, or 12,800 acres in the present proved area. About 500 acres are held by other operators, although it is possible this may be stretched to more area with further drilling. About 10 wells have been drilled by operators other than the Carter. The others have followed the 10-acre spacing common in the Mid-Continent and in other Illinois areas.

One unit development deal has been worked out between Carter and one of its offset neighbors but it is not certain now whether others will come in on the two wells to 40 acres plan. If not, some deviation from the basic pattern might have to be made to take care of offset requirements. However, it is believed that in the main the spacing plan followed by Carter thus far will be maintained.

The company has done considerable pioneer work in the development of conservation practices in Oklahoma and Kansas and has proved to its satisfaction that fewer wells, properly operated so as to make effective use of reservoir pressure, will recover as much or more oil at far less cost than is the case with close spacing and inefficient rates of flow. Prime examples to which it points are the South Burbank and Keokuk fields of Oklahoma.

Efficient Flow Is Basis

The Louden pool, known also as the Beecher City pool, produces from the Bethel sand found between 1500 and 1600 feet in depth. Initial rates of flow are from 50 to 300 barrels daily. Carter's plan at the outset is to take not more than 40 barrels per well but, if it finds that the efficient rate of flow is more or less than 40 barrels, it will change its production practice accordingly and will also change the amount it will buy from connections other than its own. Its purchases from other producers, according to present plan, will be ratable with its own as to the amount per well, giving due effect to the spacing plan which Carter is following.

Carter is a thorough believer in the benefits of maintaining pressure in oil fields. In recent years the practice of returning gas to the producing sand has been growing. Formerly, restoration of pressure was resorted to only after the field had gotten to the stripper well stage and was about ready for abandonment. The Louden field has a low gas factor and it is probable that the gas supply will be augmented either by deeper drilling or by purchasing residue gas; however, all the gas that comes from the Bethel sand oil wells will be saved and returned to selected key wells in the field.

Assists Other Operators

In its announcement of purchasing and operating policy the company offered to assist other operators in maintaining pressure under arrangements to be worked out in each case.

The statement made by the company is of interest as it is one of the most complete declarations that has yet appeared when a new pool was being fitted into the oil market. The company began by saying it was posting a price of $1.35 per barrel, Sept. 1. "As we are committed to the principle of ratable taking we will purchase crude from the property of other operators who choose to sell to us upon the same basis as we take crude from our own properties in the field," said the statement of President J. J. Conry.

"We are greatly concerned that the Louden pool shall be developed and operated under conditions which will lead to the largest possible recovery from the pool and in that larger recovery all royalty owners and operators, including ourselves, will share. To this end, in the development and operation of our own properties, we have already put into effect, or in the immediate future will put into effect, certain practices that will lead to the largest possible recovery from the pool for the common benefit of all persons interested therein.

Gas To Be Conserved

"First of all, we have developed our properties on the basis of two wells to 40 acres, these to be located in the center of the diagonal 10-acre tracts in the forty. This practice alone will conserve the gas energy for larger production, prevent the escape of gas from solution, the most important agency in producing oil and, through the latitude of two wells to 40 acres, located as here indicated, we will be able to put into operation other methods for larger recovery.

"In the second place, by long experience we have learned that, where the wells in an oil pool are produced at their efcient rate, the eventual recovery very substantially will be larger. This practice we mean to put in force in the Louden field in both producing and taking oil from our own properties. To the extent that our development of the field has proceeded our engineers are of the opinion that the efficient rate of production from a 40-acre tract is 40 barrels per day when one well only has been drilled on the tract and 80 barrels per day from the forty when two or more wells have been drilled to the forty.

"By thus taking 80 barrels from the two or more wells on the forty there is latitude in taking more from one well than from another within the 80-barrel limitation, if a particular well will not produce its 40 barrels, or if one of the wells is producing at a low gas-oil ratio, while the other or others are producing at high gas-oil ratios.

To Put Gas Back

"The third method for enlarging recovery, which we mean to put into effect just as soon as the necessary equipment is installed, is to maintain the pressure of the producing formation by injecting residue gas into the formation. This not only will increase the propulsive force of the gas for producing purposes, but it will to the fullest extent possible continue to hold the gas in solution with the oil, thus enlarging recovery.

"All of the methods for larger recovery that we have decided upon are of supreme importance when the low gas volume of the Louden field is taken into consideration."

Refiner Blames Price Cut On Under-the-Market Oils

N. P. N. News Bureau

By LAWRENCE E. SMITH

TULSA, Sept. 3. — "Crude oil is being sold under posted prices in East Texas, Arkansas, Louisiana, Kansas and Illinois. We are having to meet this competition with our refined products throughout the northern states."

Thus spoke an official of the Rock Island Refining Co. of Duncan, Okla., last week in announcing that company was reducing the price it would pay for Southern Oklahoma crude 10 cents a barrel on high gravity oil and as much as 33 cents a barrel on low gravity crude. The company's reduction followed reductions in crude prices made previously in other southwestern fields.

The statement from a refining standpoint is worthy of amplification and further explanation of the situation that has developed in recent months in the Mid-Continent, particularly with reference to several independent refineries.

Schuler crude from southwestern Arkansas for some time was transported to East Texas and refined in plants there along with East Texas oil, and in competition with the latter crude. A considerable amount of Lisbon, La., crude also was moved to East Texas plants. Some of this crude was obtained at $1 a barrel at the refinery, as compared with the East Texas price of $1.35 at the well.

It does not take a student of higher mathematics to figure how far out on the limb the refiner found himself if he was paying the posted price for his East Texas crude and attempting to compete in the refined oils market with products made from Schuler or Lisbon or a mixture of the two with East Texas oil.

Three for Two

Then there is the KMA field right in the back yard of the North Texas refining district. It is common knowledge that oil produced over and above what the pipelines can handle has been offered on several bases. Reports late last week were that there had been offers on the basis of the refiner buying two barrels at the posted

(*Continued on page* 20)

Federal Trade Commission Says 'Free Goods' are OK

By Teletype
N. P. N. News Bureau

WASHINGTON, Sept. 6.—Distribution of "free goods" to retail customers who have fulfilled certain pre-determined advertised requirements, such as the purchase of a stipulated amount of goods, is not an unfair method of competition, the Federal Trade Commission has ruled.

The opinion, which may be applied to practices of oil marketers and retailers who give "premiums" to customers for certain purchases, holds that the "real test, except where the practice is employed by large concerns to eliminate weaker competitors, is whether there is a deception of the purchaser or use of a lottery method or chance device in the distribution of the 'free goods'."

Complaint in the case was brought by the trade commission against Samuel Stores, Inc., a retail chain operating in the eastern and mid-western states, charging that the company, in representing that certain gifts would be given free with purchases of various amounts of merchandise, was including the cost of the "free" articles in the amount paid for the original purchases.

The F.T.C.'s opinion in the case contains a general discussion of "free goods" offers, and concludes:

"Where, as in this case, advertisements offering the 'free goods' clearly and conspicuously state the terms and conditions under which the 'free goods' may be secured, the merchant does not occupy a monopolistic or near-monopolistic position, the 'free goods' are not distributed by lot or chance, and there is no deception through fictitious price marking of the goods sold, or through substitution of inferior merchandise, or otherwise, the 'free goods' offer does not constitute, in the opinion of the commission, an unfair method of competition, and the complaint is accordingly dismissed."

Price-Posting In N. J.

TRENTON, N. J., Sept. 6.—New Jersey's motor fuel tax department will take steps soon against dealers selling below their posted prices, according to Joseph L. McLaughlin, director. This move, which is expected about the middle of this month, will be the first by the department which has been policing the state regulations for sale of motor fuels.

New England Prices Reduced by Socony

N. P. N. News Bureau

NEW YORK, Sept. 7. — Socony-Vacuum Oil Co. today announced it would reduce its tank car gasoline prices 0.3 to 0.5 cents throughout certain areas in New York and New England, and tank wagon prices to undivided dealers 0.4 to 1 cent per gallon throughout the same area, effective Sept. 9.

Socony's tank car prices in the trading areas of Boston and Providence will be reduced 0.5 to 7 cents; Portland will be cut 0.5 cents to 7.25 cents; Albany down 0.5 to 7.30 cents, and Buffalo tank car will be reduced 0.3 to 8.10 cents per gallon.

The company's dealer tank wagon prices at Boston and Providence will be cut 0.5 to 8 cents, Portland 1 cent to new price of 8.5 cents, Albany down 0.5 to 8.8 cents and Buffalo will be reduced 0.4 cents to 8.6 cents.

No changes will be made in dealer tank wagon prices in the trading areas of New York City, Binghamton, Syracuse and Batavia, N. Y., Brockton, Worcester and Fall River, Mass., Bridgeport and Hartford, Conn., the company announced.

"Normal" dealer prices are being restored in the "depressed markets" Bangor, Waterville and Skowhegan, Maine, the company stated.

New Type of Tanker

CLEVELAND, Sept. 3. — Something new in the way of an ocean-going freighter arrived at the Standard of Ohio's terminal here. She was the "Dolomite 4", loaded with a million gallons of gasoline from Chicago. Built of steel channels bent to form her frame, she was of all-welded construction. Lined with sheet nickel and specially equipped, the holds can be quickly cleaned after discharging so that she can be quickly reloaded with any type of bulk cargo. In the fall, the vessel will be transferred to New York for ocean service, hauling caustic soda in coastwise trade.

Margins Vanish As 'War' Rages In Philadelphia

By Telegraph

PHILADELPHIA, Sept. 7.—All leading supplying companies, it was reported today, have followed the reduction of 1.25 cents in undivided dealer tank wagon prices in the Philadelphia area announced by Sun Oil Co. on Sept. 1. Reduction makes the price to dealers 6.5 cents, exclusive of 5 cents tax, on regular grade.

Posted prices at service stations today were generally 8.5 cents ex tax, observers said. Some postings of 7.9 cents ex tax were reported. This means that the dealer's gross margin generally was 2 cents or less.

Today's open spot market tank car price was 6 to 6.5 cents on high octane gasoline.

Sun Guarantees 'Spread'

Sun Oil Co. on Sept. 2 announced that for the time being it was entering into an agreement with its Philadelphia dealers guaranteeing them a minimum "spread" of 2 cents and 1.5 cents, to undivided accounts and divided accounts, respectively.

Following is complete text of the Sun's announcement:

"As a result of the chaotic market conditions in the city of Philadelphia and its suburbs, the Sun Oil Co. has temporarily entered into an agreement with its dealers to allow them a minimum spread of 2 cents per gallon on undivided accounts and 1.5 cents on divided accounts provided that such allowance does not result in a net tank wagon billing price to the dealer of less than 11.5 cents, including taxes, to undivided accounts and 12 cents to divided accounts. The company's posted tank wagon market will remain unchanged but the tank car market to commercial consumers will be reduced to 6 cents plus 4 cents state and 1 cent federal taxes, thus making its tank wagon price to large consuming accounts the same as the minimum price to the undivided dealer."

Sinclair Specifies Prices

NEW YORK, Sept. 6. — Sinclair Refining Co. has formally announced that, effective Sept. 1, it is specifying minimum retail prices on its branded gasolines in New Jersey and five New York counties under these states' fair trade laws, confirming NPN's story of last week.

Michigan Oil Men Meet Sept. 22-23

PORT HURON, Mich., Sept. 2.—The fall convention of the Michigan Petroleum Assn. will be held Sept. 22 and 23 at Park Place Hotel, Traverse City, according to J. F. Wilson, president.

The sessions open with a luncheon the first day, followed by a business meeting in the afternoon. The next day will be devoted to sports. A banquet in the evening of the second day, for which a guest speaker is being arranged, will close the two-day meeting.

Sports will include fishing, golfing, bowling and a shuffleboard contest. Grand Traverse Bay is famous for trout fishing, being 270 feet deep. Other attractions in this region are the Sleeping Bear Sand Dune, the zoo and aquarium in Clinch Park, Wilson said.

Two New Tankers

WASHINGTON — Two new oil tankers were contracted for during July — one by Socony-Vacuum Oil Co. and the other by J. H. Coppedge & Co., the Commerce Department reports. Besides this, Texas Petroleum Co. contracted for four vessels for foreign trade (service not given).

Acetylene Congress To Meet At Munich

N. P. N. News Bureau

CLEVELAND, Sept. 6.—The thirteenth International Congress of Carbide, Acetylene, Oxy-Acetylene Welding and Allied Industries will be held in Munich, Germany, from June 25 to July 1, 1939, it is announced by the International Acetylene Assn. While no program nor speakers are announced a general outline of subjects has been prepared in which oxy-acetylene welding will receive special emphasis. A technical exposition is also planned to show the present status of these industries.

Dr. Schmitz, chairman of the board of directors of I. G. Farbenindustrie, will preside at the Congress. Vice presidents Dr. Rimarski, president of Chemisch-Technischen Reichsanstalt, Dr. Kessner, professor and director of the Mechanical Institute of the Technischen Hochschule of Karlsruhe, and F. K. Kruekl of Vienna are in charge of arrangements for the Congress.

Inquiries should be directed to the office of the Congress in Berlin-Friedenau, Bennigsenstraffe 25, Berlin.

Jobber Saves Tank Using N. P. N. Inspection Form

CHICAGO, Aug. 15.—A checkup of only two of its five bulk plants, using N. P. N. Bulk Plant Inspection Forms, already has saved an independent jobbing company in the middlewest many times the cost of an entire year's supply of the inspection series as now published in booklet form.

Officials of the company became interested in the inspection plan when it first appeared in NATIONAL PETROLEUM NEWS. Five copies of the magazine were obtained and the inspection forms cut out and sent to each of the bulk plant operators.

When the form was filled out and returned from one of the bulk plants it was learned for the first time at the home office that one of the kerosine storage tanks will have to be raised and new supports put under it right away. Otherwise the tank is likely to need an entire new bottom before next spring.—From N. P. N. Aug. 17.

NATIONAL PETROLEUM NEWS now offers three Easy-To-Use tools for cutting your marketing costs in Bulk Plant, Service Station and Truck operation.

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The 230 questions in this form enable you to inspect every piece of your station equipment.

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Here are 24 pages of questions. You can scrutinize your plant and trucks closely with this inspection form, but it's easy to use.

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We Approve Mr. Arnold's Idea—

Congress May Get the Truth

By WARREN C. PLATT, Editor

Probably one of the fairest things it could do, and for the best interest of the oil industry and the general public, would be for the Department of Justice to base its proposed appeal to Congress for changes in the anti-trust laws, on the Madison oil cases.

Then, unless Congress should be utterly under the thumb of the President, which does not now seem probable, the facts that the Department has fought to keep out of the case, to avoid its own embarrassment, could be brought to light in detail.

The Department of Justice, in a recent statement signed by Assistant Attorney General Arnold in charge of the anti-trust division and countersigned by Attorney General Cummings, announces it is going to make just such an appeal. We hope the department does not forget about it by the time the new Congress sits.

Mr. Arnold, in his statement, refers to a fact in a way to put the oil companies involved in the worst possible light and yet what is back of that fact constitutes a long story with the government as the chief factor. This story, Congress should develop when it is asked to consider changes in the anti-trust laws.

Mr. Arnold in several places speaks of the oil companies "unlawfully extracting millions from the purse of the consuming public"; and in the trial of the case government counsel frequently referred to "$90,000,000" allegedly taken from the public by the "conspiracy."

The higher courts will be given opportunity to decide finally as to the "unlawful" part. But whether "unlawful" or not the government certainly about broke its neck trying all sorts of ways by which it could "extract" those same "millions" for the benefit of the oil industry and that part of the public dependent upon it, to say nothing of what the government itself would get out of it in taxes and royalties and higher wages and shorter hours.

Neither Mr. Arnold nor his associates at the trial had the fairness or honor or honesty—perhaps one might also add the courage—to say that, for two mighty long and unprofitable years for most in the oil industry, a brother cabinet member of Attorney General Cummings, with the approval of President Roosevelt and part of the time with the assistance of the Department of Justice, had been striving with might and main to devise and make effective some means of collecting those very "$90,000,000"—if that is the correct amount—from the general public in order to make good the pegged price for crude oil demanded by government.

The federal government talked of all sorts of schemes and tried many, and sought and got new laws for the purpose of getting this money from the public through the medium of primarily raising the tank car price for gasoline and thus raising the retail prices and thus causing the public to pay for this advance in the price of crude oil asked by the government and carried out by the oil industry, in fact by the very companies arraigned at Madison. Government officials even worked out a plan which came within a hair of being adopted, whereby the government would order these same increased prices into effect and then police the industry's adherence to them, all for the sole purpose of "extracting" this "$90,000,000 from the purse of the consuming public."

Mr. Arnold says nothing—nor did his associates in the court room—about how the Department of Justice took case after case into court to aid the Roosevelt Administration in its effort to collect this money from the consuming public. In fact the Department of Justice did quite commendable work to effect this collection and we said so at the time, to the confusion of the amateurish effort of some of the associates of the Petroleum Administrator, who occupies a prominent position in the President's cabinet under the title of Secretary of the Interior.

Then at last came the spring of 1935 but neither Mr. Arnold nor his associates at the trial want to be frank about that spring nor all that occurred then, let alone all that went before. Mr. Arnold, nor did his associates, says nothing about the frantic efforts of government officials, including the President, to bring about passage of the Connally "hot" oil law, that shut off a flood of some 40,000 barrels of "hot" gasoline that flowed up the Mississippi valley every day and wrecked the gasoline markets over a score of states. Mr. Arnold says nothing about government limiting by order the amount of gasoline each refiner could manufacture and how those orders were purposely, and avowedly so, planned as to force the big refiners to use up their gasoline stocks and then have to go into the open market to buy.

Mr. Arnold says nothing about the pleas of high government officials—yes even of a cabinet member—to various long suffering refiners not to cut the price of crude but to wait and see if the new efforts could not "extract millions from the purse of the consuming public" and thus make the cut unnecessary. Nor does he tell of the formula in the oil code to set a higher price for gasoline, a higher price than finally came from all these joint efforts, nor of the 7000 oil marketers who sat in countless committee meetings under government auspices trying to do what? Trying to get this "$90,000,000 from the public's purse."

Then it was the right thing to do. In fact then the industry was threatened with drastic regulation, even to being made a "public utility" by the federal government, if it did not get these prices up so as to hold that price of crude which government demanded.

When did it cease to be the right thing to do and become morally wrong, as Mr. Arnold's statement and the statements of his associates in court, now condemn it?

The law suit was over just one incident out of all the many incidents that happened that spring to bring about the advance in price. That one incident was a sorting out of buying orders for gasoline, called a "buying program."

The government singles that out of all the other things that were done by both government and industry to accomplish their mutual purpose of raising prices, and says that buying was illegal. The oil companies say it was not illegal. The higher courts will decide.

But whatever the outcome of that argument the fact remains that the "$90,000,000" pointed to in the trial and the "millions extracted from the public purse" that Arnold talks about are the same millions that the government worked for two years to help the oil companies get, the same millions that the government said it was necessary for the industry to have to protect the price of crude that the government, and the industry and the oil states, so badly wanted. And here in the last few weeks, for the lack of these same millions, the oil companies have found it necessary to cut the price of crude below that amount urged by government.

Assistant Attorney General Arnold protests the smallness of the fines assessed and complains that "penalties should be measured chiefly with reference to the economic injury inflicted on the public." It might be suggested to Mr. Arnold that the trial judge evidently did just that, he having heard finally the story that the Department of Justice did not want him to hear, about how the government was trying to get up the price of crude oil and the price of gasoline. If Mr. Arnold will look further into the case and the facts behind it, he will find plenty of testimony from some of the best experts the government has and could get that "extracting these millions" did not "inflict an economic injury on the public."

The pity of it all is that Congress and the American public have enough difficulty wrestling with the new and complex problems of the relation of government to business, without these being unnecesarily complicated by public officials who withhold facts and do not tell the truth.

It would be for the best interest of all that Mr. Arnold take his story to Congress where, we have reason to hope, there will be representatives of the people who will make all public officials adhere to their oaths as officers of the government and as witnesses before the people "to tell the truth, the whole truth and nothing but the truth, so help you God."

Less Fire and Brimstone, Please

Some of these railroad brotherhood leaders seem to be getting more vociferous and ferocious as they proceed with the routine toward calling a possible railroad strike. Maybe they will be foolish enough to call a strike, but we doubt it.

However, if they do, this prophecy should be a safe one; that it will be the last strike ever called by these brotherhoods and we do not mean by that that the government may then be forced to take over the railroads, which probably is what the brotherhoods want so they can have a big hand in the political management of the roads.

A railroad strike, shutting down that form of transportation over the country, will bring out in the strongest way possible, the tremendous development and expanse of the other means of transportation, water and truck, with the gasoline supplied not only by these two non-railroad methods but also by pipelines.

If the brotherhoods arrange for "sympathy strikes" among truck drivers and such water carriers as may be unionized, then the people of this country will have to decide just who the United States is operating for, some union leaders or the general public? As operating trucks and even much water transportation does not call for any particular skill on which any one labor union has a monopoly, it is easily conceivable that the railroad strike, if any, will certainly end the way the one did in England some years ago when the whole country rose up and took charge of things.

The railroad brotherhoods on the whole have enjoyed a most enviable reputation for conservative, fair and intelligent conduct. They have gotten off the track a few times, especially when they went into the banking and apartment house business. Their banks turned out to be about as sour as any the country has known but their apartment houses were quite good for all except the stockholders.

If the rank and file of the brotherhoods, however, do not soon deprive some of their officials of the fire and brimstone they are hurling, people will begin to suspect that John Lewis has put a C.I.O. Communistic noose around their necks.—W.C.P.

'Gasoline Post Offices'?

Now the government would cut out the milk distributors by establishing "milk postoffices," to which the consumers would come and buy milk cheaper than at privately owned stores or when delivered by the usual milk trucks. Once this starts then it will be easier to follow with something else, as other "food postoffices," perhaps even "gasoline post offices." The departments of justice and agriculture are said to be planning the government venture into cheaper milk stores. Why the Department of Justice, we don't know but it only the more strongly suggests that the Department might next consider gasoline.

Los Angeles Dealers Favor Tighter Oil Marketing Law

N. P. N. News Bureau

LOS ANGELES, Sept. 3.—Early returns on the questionnaire sent out by the Retail Petroleum Dealers Assn. indicate that a large majority of the association's membership favor more legislation and more "teeth" in laws already on the books aimed at discounting and other "unfair" marketing practices.

Sounding out dealer reaction to several legislative proposals likely to be introduced at the 1939 session of the California legislature, the R. P. D. A. circulated among its members a questionnaire with the following questions:

Legislative Proposals

1. Do you favor legislation prohibiting gasoline price signs other than postings on the pump?

2. Do you favor putting teeth in the law requiring that the ACTUAL SELLING PRICE be posted on the pump?

3. As a safety measure, do you favor the compulsory inspection by the state of all motor vehicles?

4. Do you favor a law prohibiting the re-branding of gasoline as a move against cut prices?

5. Do you favor widespread use and strengthening of the Fair Trade law as a profit protection to you?

6. Do you favor an amendment to the Unfair Practices Act which would prohibit discounts for other than re-sale purposes?

7. Do you favor any other proposed law for the benefit and protection of dealers? If so list it here.

Although no tabulation has been made of answers received to date, an examination of about 50 showed almost complete agreement in favor of the six of the seven proposals.

The proposal covered by the first question is aimed at elimination of curb price signs, desired by dealers facing cut price competition, attempting to maintain prices with large signs to advertise lower prices.

Price Posting Law

R.P.D.A. members favor proposal No. 2 because it is thought such an addition—probably to the Oil and Gas Substitution Act—would go a long way toward eliminating under-canopy price cutting on branded gasolines and motor oils. It was believed the substitution act carried such a provision when passed by the 1937 legislative session, but a subsequent ruling by the state attorney general declared this was not the case.

Compulsory inspection of motor vehicles—regarded as certain to be proposed at the 1939 meeting—was the only proposal to be opposed to any extent by the dealer group.

Further efforts to strengthen the fair trade law with respect to marketing of petroleum and other liquid products, are expected, and it is also anticipated that a move will be made to prevent re-branding of gasolines, now provided for by the substitution act, however, such action would not be popular with the average dealer handling independent products.

The R.P.D.A. has made a strenuous fight to prevent commercial accounts from selling to employes and others at a discount, and is expected to back

the proposal No. 6 which would prohibit discounts to commercial consumers.

Backyard Pump Ban

In line with this, several questionnaires returned carried comments on this practice. One favored a law requiring rigid fire inspection of all "back-yard" gasoline pumps and others used except for resale purposes. Another would prohibit business concerns from selling their employes motor fuel at a discount. Elimination of all discounts to city and county employes by the purchasing department, was suggested by another member.

It was also suggested that major oil companies should be stopped from selling gasoline to anyone who has a pump in the backyard. One answer recommended suppliers give the same discount for 100 per cent and split stations.

The R.P.D.A. will make a thorough study of answers received to this query in establishing its program for the 1939 legislative session.

Anti-Trust Speaker Listed By N.O.M.A.

N. P. N. News Bureau

WASHINGTON, Sept. 6. — Wendell Berge, chief assistant to Thurman Arnold, assistant attorney general in charge of the justice department's anti-trust division, will be one of the principal speakers on the program of the annual convention of the National Oil Marketers Assn. at the Morrison Hotel, Chicago, Oct. 24-25, it was announced today by Paul E. Hadlick, secretary.

Berge, who is also Arnold's alternate on the O'Mahoney anti-monopoly investigating committee, will speak on the anti-trust laws and work of the monopoly investigating committee, Hadlick said.

It was a complaint to the justice department in 1935 by the N. O. M. A. which precipitated the investigation culminating in indictment of a number of major oil companies at Madison, Wis., on charges of violating the anti-trust laws.

Sohio Tank Car Cut

CLEVELAND, Sept. 1.—Effective today, Standard Oil Co. of Ohio announced an 0.125 cent reduction in its posted tank car gasoline prices. Sohio's new delivered prices for shipment anywhere in Ohio are: U. S. Motor, 8.0 cents; above 65 octane, 8.25 cents.

Missouri Group Complains To Department of Justice

N. P. N. News Bureau

CLEVELAND, Sept. 6. — Charges have been filed with the Department of Justice that certain Kansas City manufacturers have "conspired" with certain oil companies in that area, including jobbers and retailers, to supply factory employes with petroleum products at a discount, according to a letter received today by NATIONAL PETROLEUM NEWS from L. A. Hartley, secretary of the Petroleum Retailers Assn. of Greater Kansas City.

These manufacturers, according to Hartley, have no right under their charters to sell petroleum products.

It is further charged, the association secretary said, that such discounts to the factory employes are given in lieu of wages and were not accounted for in filing social security taxes.

The association also attacked legality of some station leases, contending that they were "subterfuges" by the supplying companies to avoid payment of social security taxes, he said.

Charges were also made, Hartley said, of violations of the Wagner labor law, the Miller-Tydings law, the Robinson-Patman law, and the fair labor standards law. Nature of the charges under several of these laws was not disclosed.

Text of Hartley's letter follows:

"The Petroleum Retailers Association of Greater Kansas City has filed information with the United States Department of Justice involving the operations of most of the local oil companies, many local oil jobbers, several local retail dealers, a number of well-known Kansas City business men, one large real-estate firm and a number of individuals charged with being accessories to violation of various federal acts.

"Charges of collusion to fix prices downward in the retail field and to avoid responsibilities of the Wagner Act, the Miller-Tydings Act, the Robinson-Patman Act, the Social Security Act and the Fair Labor Standards Act are made by the Kansas City Association.

"Instances are given of asserted collusion between certain suppliers to deny certain lessees of other oil companies merchandise after one allegedly conspiring oil company had refused to deliver gasoline to a lessee with months to go on an unexpired lease. The Kansas City Association, in the charges filed with the Department of Justice, has attacked the legality of many leases under the assertion that most of these leases are and have been submitted by oil companies to lessees as a subterfuge to escape responsibilities of the various federal acts, avoid operations costs and evade taxes.

"It is specifically charged by the Association that the oil companies named in the information conspired to shift the burdens of Social Security taxes to selected employe-victims of the conspiracy while depriving these selected of their inherent rights under the Social Security Act. It is specifically charged that certain of these oil companies against whom this information is filed, and their officials, entered into a conspiracy to fix prices downward by influencing certain strategically located filling stations to discount and offer costly free services.

"It is specificaly charged in this information that certain manufacturing firms in Kansas City have conspired with certain oil companies and certain local oil jobbers and retail dealers to supply employes of their factories at certain discounts on petroleum products. It is charged that the state charters under which these manufacturing firms operate do not grant these firms the right to merchandise petroleum products.

"It is charged that all such discounts to these factory employes are given in lieu of wages. It is asserted in these charges that wages paid by these manufacturing firms are considered inadequate by groups representing these employes in issues brought to the attention of the National Labor Relations Board. It is specifically claimed by the Kansas City Association that all such discounts given in lieu of wages are not accounted for in Social Security tax returns as provided by the Social Security Act."

Justice Department Withholds Comment

By Teletype
N. P. N. News Bureau

WASHINGTON, Sept. 6.—Department of Justice officials today declined to confirm or deny receipt of a complaint from the Petroleum Retailers Association of Greater Kansas City charging violations of a number of federal laws by oil companies in that area.

The federal fair labor standards law (more commonly known as the wage-hour law) which was one of the laws allegedly violated, does not go into effect until Oct. 24, 1938, it was pointed out.

The Miller-Tydings law concerns resale price maintenance contracts, such as have recently been put into effect by oil companies in New Jersey and the New York City area. If oil companies in the Kansas City area have made use of state fair trade laws to specify minimum prices on their branded gasolines or other products, no word of such action has reached here, it was said.

Price-Posting Cases Are Pushed In Iowa

SIOUX CITY, Ia., Sept. 6.—Although there have been some indications that certain county prosecutors are not overly-enthusiastic about bringing action against alleged violators—particularly in an election year, supporters of Iowa's price-posting law are hopeful that the wheels of justice can be speeded up this fall.

Two cases alleging violations of the law against selling at other than prices posted, which is part of the Iowa motor fuel tax law, submitted to the Sioux City municipal court by Assistant County Prosecutor Gerald Harrington late in July. The court took them under advisement and a decision is expected before long. Both cases arose in Woodbury County.

Should the decision be adverse in these cases, it is understood that the state attorney general's office will carry them to the Iowa supreme court for a final ruling.

Several cases under the price-posting law were tried last winter in Des Moines. But the price-posting provision of the tax law was held unconstitutional. Lack of a record in these cases prevented the attorney general from appealing the rulings, it was understood.

Prominent in the effort to obtain enforcement of the state price-posting law is the Iowa Independent Oil Jobbers' Association, with A. C. Gienapp, Manchester, Ia., association secretary, doing much of the "follow up" work.

North Dakota Vapor Pressure

BISMARCK, N. Dak., Sept. 6. —North Dakota's oil inspection division has issued a "warning" that its 9-pound limit on vapor pressure on gasoline samples taken in the state continues in force until Oct. 1, after which the limit is 13 pounds per square inch.

'38 Gasoline Consumption Shows Gains In 35 States

N. P. N. News Bureau

NEW YORK, Sept. 3.—Thirty-five states weathered the business recession in the first half of 1938, coming through with increased gasoline consumption as compared with the same period of 1937, according to an analysis of state gasoline tax collection figures collected by the American Petroleum Institute. And these gains were registered despite a general decrease in June.

For the entire U. S., the tax figures for the January-June period indicate a gain of 1.06 per cent over 1937—last year gasoline consumption smashed all records.

Of the 13 states showing decreases, four—Connecticut, Massachusetts, New Hampshire and Rhode Island—were in New England. Four others were industrial states where the recession hit hardest; they were New York, Pennsylvania, Ohio and Michigan.

The other four with decreases were West Virginia, Indiana, Tennessee and California (and very likely Californians will blame their decrease of the "unseasonal" weather which included floods). District of Columbia gained 2.09 per cent.

Largest increases during the six-month period were in the farm belt, with South Dakota's 16.17 per cent increase the largest gain registered; North Dakota, second, with 9.64 per cent increase; and Minnesota, third, with 8.35 per cent.

Net increases for the six months ending with June were registered despite the fact that for the U. S. there was a decrease of 1.6 per cent as compared with June, 1937. Only 15 states and the District of Columbia showed an increase in June over 1937 figures, the A. P. I. report indicates.

Gains in June were mostly in the farm belt and along the South Atlantic seaboard. Louisiana showed an increase of over 10 per cent, while Texas was up 3.68 in June.

Detailed figures for the January-June period and for June, alone, for all states, with percentage of change as compared with same periods of 1937, are given in accompanying table.

Fire Kills Three

N. P. N. News Bureau

TULSA, Sept. 6. — An explosion and fire following the bursting of a butane tank at the Odessa, Tex., natural gasoline plant of the Barnsdall Oil Corp. caused the death of three employes Aug. 30. The workmen were R. H. Brooks, Glen Carlton and G. T. Scott. Several other workmen narrowly escaped. The $300,000 plant which was placed in operation this summer was partially wrecked.

GASOLINE CONSUMPTION BY STATES, JUNE, AND FIRST SIX MONTHS, 1938

(Figures in Thousands of U. S. Gallons)

	Month of				6 Months Ended With		
	May, 1936 Gallons	June, 1938 Gallons	June, 1937 Gallons	% Change 1938 over 1937	June, 1938 Gallons	June, 1937 Gallons	% Change 1938 over 1937
Alabama	18,803	18,554	18,810	— 1.36	109,470	107,454	+ 1.88
Arizona	8,359	8,995	9,288	— 3.15	50,761	50,274	+ 0.97
Arkansas	13,435	13,503	14,263	— 5.33	76,573	76,075	+ 0.65
California	145,900	157,451	158,511	— 0.67	848,170	855,834	— 0.89
Colorado	19,567	21,214	20,805	+ 1.96	104,318	101,244	+ 3.04
Connecticut	27,826	28,924	30,301	— 4.54	146,274	150,223	— 2.63
Delaware	4,963	5,364	5,151	+ 4.13	25,839	25,589	+ 0.98
District of Columbia	12,033	12,223	12,110	+ 0.92	67,336	65,957	+ 2.09
Florida	26,238	24,461	24,509	— 0.19	178,225	171,298	+ 4.04
Georgia	27,491	27,382	27,864	— 1.73	162,109	158,645	+ 2.18
Idaho	8,356	8,964	9,204	— 2.61	41,132	39,321	+ 4.61
Illinois	119,021	119,725	118,706	+ 0.86	623,411	605,633	+ 2.94
Indiana	58,368	56,898	60,090	— 5.31	300,526	301,055	— 0.17
Iowa	49,811	50,807	47,976	+ 5.90	251,225	234,730	+ 7.03
Kansas	38,988	52,819	52,522	+ 0.56	222,554	215,740	+ 3.16
Kentucky	21,516	22,090	22,823	— 3.21	119,057	118,148	+ 0.77
Louisiana	20,443	22,161	20,136	+10.06	118,946	112,017	+ 6.18
Maine	12,697	13,890	14,242	— 2.47	60,808	59,848	+ 1.60
Maryland	23,120	24,328	24,592	— 1.07	127,918	125,230	+ 2.15
Massachusetts	60,079	63,142	66,055	— 4.41	312,197	321,214	— 2.81
Michigan	92,169	94,675	104,229	— 9.17	485,777	518,053	— 6.23
Minnesota	44,450	50,746	48,378	+ 4.89	239,050	220,632	+ 8.35
Mississippi	17,195	15,945	17,303	— 7.85	91,668	89,883	+ 1.98
Missouri	50,583	53,016	53,302	— 0.54	282,554	275,099	+ 2.71
Montana	10,578	11,279	11,307	— 0.25	53,221	51,621	+ 3.10
Nebraska	19,427	21,196	21,181	+ 0.07	106,788	105,601	+ 1.12
Nevada	3,225	3,779	3,840	— 1.59	16,799	15,977	+ 5.15
New Hampshire	7,227	7,902	8,255	— 4.28	36,308	36,548	— 0.66
New Jersey	74,265	75,990	75,111	+ 1.17	391,309	382,869	+ 2.20
New Mexico	7,522	7,909	7,996	— 1.09	42,268	40,867	+ 3.43
New York	160,424	164,357	165,749	— 0.84	825,311	837,768	— 1.49
North Carolina	32,099	32,427	32,694	— 0.81	186,450	183,473	+ 1.62
North Dakota	11,126	12,377	11,562	+ 7.05	57,811	52,729	+ 9.64
Ohio	113,376	111,349	119,310	— 6.67	605,978	623,670	— 2.84
Oklahoma	33,406	37,766	39,884	— 5.31	189,320	182,908	+ 3.46
Oregon	20,907	21,448	20,929	+ 2.48	105,307	101,305	+ 3.95
Pennsylvania	121,864	123,027	129,502	— 4.50	648,838	659,041	— 1.55
Rhode Island	10,572	10,737	11,132	— 3.55	54,934	57,436	— 4.36
South Carolina	15,795	15,973	15,772	+ 1.27	93,560	90,357	+ 3.55
South Dakota	10,792	13,104	12,573	+ 4.22	59,810	51,484	+16.17
Tennessee	25,481	24,675	26,016	— 5.15	138,472	126,824	— 9.18
Texas	107,832	113,209	109,186	+ 3.68	616,227	580,805	+ 6.10
Utah	7,570	9,018	8,766	+ 2.87	42,126	40,837	+ 3.16
Vermont	5,595	6,153	6,350	— 3.10	27,359	26,932	+ 1.58
Virginia	29,126	30,079	31,053	— 3.14	164,813	159,832	+ 3.12
Washington	29,539	30,666	30,954	— 0.93	155,742	150,577	+ 3.43
West Virginia	16,479	16,742	18,201	— 8.02	89,244	92,351	— 3.36
Wisconsin	49,018	51,589	52,271	— 1.30	246,494	244,133	+ 0.97
Wyoming	5,065	*5,983	6,551	— 8.67	26,532	26,602	— 0.26
Total	1,849,725	1,926,011	1,957,317	— 1.60	10,026,919	9,921,743	+ 1.06
Daily Average	59,669	64,200	65,244	— 1.60	55,397	54,816	+ 1.06
Change from previous year:							
Total change	.....	—31,306	.....		+105,176	.....	
Percentage change in Daily Average	.....	—1.60%	.....		+1.06%	.....	

* We believe this figure to be entirely comparable with those previously published for earlier months. Taxes were assessed during June, however, on an additional 3,300,000 gallons of gasoline held in storage. How this gallonage should be distributed over prior or succeeding months is, of course, impossible to say.

Penn Grade Cut 12c, But Prices Hold Up On Refined Products

N. P. N. News Bureau

CLEVELAND, Sept. 6. — Prices of products from Pennsylvania grade crude oil have apparently borne up under the shock of another cut, this time 12 cents per barrel, in crude prices effective Sept. 1 posted by leading purchasing companies.

Indeed, some Pennsylvania refiners have reported advances in their quotations on the lighter products since the crude cut announcements, (See *Markets*, Page 42 for details).

New prices range from $1.18 for Buckeye crude to $1.68 for Bradford-Allegany. The latest cut is the sixth in a series of reductions, the first of which came exactly one year previous, Sept. 1, 1937. These reductions have carried prices down a total of $1.14 to $1.24 per barrel.

Officials of some companies mentioned "general conditions" and "overproduction with crude going into storage", in discussing background of today's crude price cut.

Trade reports have indicated substantial improvement in the statistical position of Pennsylvania refined oils in the past three or four months.

Refinery crude runs, however, have been curtailed, and stocks of Pennsylvania grade crude have continued to mount, it was pointed out.

Since the last previous reduction in crude prices on June 13, stocks have increased 291,000 barrels to 6,180,000 barrels (4.9%) on Aug. 20, figures of the Bureau of Mines show.

The increase in stocks since Sept. 1, 1937, when the first cut was made, stocks have increased nearly 48 per cent, according to Bureau of Mines figures.

Today's new price of $1.68 for Bradford-Allegany is 41 cents above the all-time low of $1.27 reached in May, 1933. (See Page 22 for prices.)

Virginia Tax Receipts Up

RICHMOND, Va., Aug. 31.—Although tourist trade in Virginia this year is 37 per cent below 1937, gasoline tax collections for first seven months of 1938 ($9,826,380) were 2.26 per cent above total for same period last year ($9,608,756), Division of Motor Vehicles reports. During month of July $1,588,665 was collected, 1.65 per cent below July 1937 collection—$1,614,322.

Total Of 'Hot' Oil Sales Runs To 4,000,000 Barrels

(*Continued from page 9*)

but now operates as a producing company. The suit asked the court to confiscate 226,074 barrels of crude and fuel oil. General American had a cross action seeking an order against the railroad commission to clear for shipment 95,955.83 barrels which it asserted was being illegally impounded and restrained.

Judge J. D. Moore started to hear the suits and counter suit the same day, August 30. These affairs have usually been routine, this one wasn't. It looked as though everybody had decided to take a hand. Gov. Allred came over to the courthouse. Railroad Commissioner Ernest O. Thompson was there. State Senator Clint Small of Amarillo, author of some of Texas' present conservation laws; Major J. R. Parten, of the Woodley Petroleum, Premier Oil Refining and other companies; Sidney Latham of Longview, attorney for the Texas Petroleum Council, were a few of the many who attended.

Trial Postponed

The judge postponed trial of the case to Sept. 2 and, when that day came around, put it over to Sept. 8. At that time District Judge Archer was to take it over, as Judge Moore's term of court ended Sept. 3.

It appeared in the numerous statements that were made that scarcely anybody except the attorney general favored the instant proceeding, although it is authorized in a law enacted in 1935. Objections centered around the low price heretofore realized for oil declared forfeit to the state and sold by the sheriffs of the counties in which the oil was stored.

Major Parten, on behalf of Premier Oil Refining Co., asked leave of the court Aug. 30 to intervene on the ground the company is interested in seeing that a fair price is paid for oil and that the conservation laws are enforced. The court gave such permission. Pending now is a motion by the attorney general to dismiss the intervention because Premier stands in no different light than any other taxpayer and has no justiciable interest in the suit.

Sale Is Criticized

Major Parten told the court that, in 48 suits disposed of up to a month ago, 3,472,000 barrels of oil had been sold and that it had brought only a little more than $900,000. He said there should be competitive bidding and that something should be done to preserve the identity of the oil, declaring that, in some instances, higher gravity oil had been substituted for that which was sold.

Gov. Allred, in press statements, said the amount that had been sold had brought an average price of 27 cents per barrel. This, he said, was unfair to legitimate oil operators and to the school fund which receives the income from the sale of oil.

G. A. Sadler, democratic nominee for Railroad Commissioner, took a hand in the opposition to the sale. He offered his services as special prosecutor to the county attorney of Travis county, said he would end the sales of oil at low prices. He offered to serve at no salary and said that a special session of the legislature to investigate the operation of the confiscation law would cost the taxpayers $160,000. The governor denied that there was any thought of calling a special session.

F. W. Fischer, Tyler attorney, defended the price realized in past sales. He said the oil involved in the General American case had been in earthen storage since 1934, was fuel oil to start with and had accumulated sand, grasshoppers and other debris. Very little gasoline could be gotten from it even by cracking, he said.

2,250,000 Barrels Left

Bookkeeping on this impounded oil has been a difficult matter. Originally there was supposed to have been about 6,000,000 barrels, nearly equally divided as to steel and earthen storage about 3,200,000 barrels of "pit oil." The attorney general's department began to file suits and sell the oil soon after the forfeiture law was passed.

A considerable amount has been removed from pits and they have been destroyed but some has not and there is a large quantity that has been declared forfeit but not yet sold. Just how much is actually in the field is hard to say, as the accounts vary, but there is agreement that the amount is somewhere near 2,250,000 barrels.

There was a legislative committee investigation in 1935 and 1936 and a report was made that criticized the attorney general's department and the Texas Railroad Commission, chiefly for non-co-operation. The commission has never liked this method of dealing with what has been paradoxically termed "frozen hot oil," meaning "hot" oil that has been impounded. The commission preferred suits to collect penalties for overproducing.

After much guessing as to the quantity, the commission employed engineers to take stock and they surveyed and sounded all the pits, ran thiefs to determine how much oil and how much water was in each pit, calibrated and gaged the steel storage. Some of the pits were miniature lakes. Total amount thus found was 5,981,856.08 barrels, of which 3,615,334.26 barrels were uncracked fuel oil, most of the rest being crude oil in steel storage.

The oil got into the pits back in the happy, care-free days when the railroad commission's authority was so sketchy there were more ways around its jurisdiction than methods of applying it. Fuel oil was nearly worthless, refiners knocked off the gasoline and ran the rest into pits. It's a long story but one that has been told many times. The crude oil, for the greater part, was that on hand when the commission was given enough authority by the legislature to put the microscope on every barrel before issuing a tender, or permit to transport.

There hasn't been much bidding at the sales over the past three years. Frequently, the owner or someone associated with or acting for him has been the sole bidder. The chief reason for this condition is the fear that a non-assailable title

Bidder's Identity Masked In Huntington Beach Bids

N. P. N. News Bureau

LOS ANGELES, Sept. 3. — Bids opened September 1st for the right to drill into California state-owned tidelands offshore from the Huntington Beach field, placed a high value on the indicated production from proven acreage and promised a substantial yield to public coffers as a result of the development.

Only three bids were submitted: Southwest Exploration Co., West Central Oil Co., and United States Refining Co., Ltd. Identity of West Coast oil interests backing these concerns was not disclosed and there was considerable speculation as to in whose hands the coveted acreage would finally fall.

Southwest Exploration was apparently high bidder with an offer 1.1 times as high as a minimum schedule suggested by the state for wells of various size. The bid was signed by Charles M. Johnson and offered the following royalties on wells of various size:

For a well yielding 80.20 barrels a day or less, 12.5 per cent of gross output; yielding 100 barrels, 16.72 per cent; 200 barrels, 30.80 per cent; 300 barrels, 38.62 per cent; 400 barrels, 43.60 per cent; 500 barrels, 47.05 per cent; 750 barrels, 52.31 per cent; 1000 barrels, 55.29 per cent; 1500 barrels, 58.52 per cent; 2000 barrels, 60.27 per cent; 3000 barrels, 62.08 per cent; 5000 barrels, 63.60 per cent.

This offer was made with respect to all five of the 160-acre parcels embracing the indicated tideland pool. United States Refining entered a bid containing a factor of 1.05667, for three parcels and West Central's offer carried a factor of 1.005. Awards under these bids will be delayed while state officials and engineers study the offers.

Trouble Looms

A new development in the Huntington Beach tideland situation promised to hold up the drilling program under this leasing arrangement.

Gordon Booth, an oil operator, has petitioned the superior court for an injunction to prevent the state land commission from entering into leases for drilling Huntington Beach tideland property, charging that the proposed leases would exclude anyone from bidding for the right to drill except those selected by Standard Oil Co. of California.

Gordon contended that, in calling for bids, the commission ruled that uplands, adjacent to the beach, must be used for location of wells to be slant-drilled into the ocean pool, and that most of these uplands have been leased by Standard and later sub-leased to Signal Oil Co. He charged that he had tried to obtain a lease on the uplands without success.

This action was filed prior to opening of the three bids made for leases on the properties. As the week closed, it had not been determined whether this suit, or others threatened by the City of Huntington Beach would halt development of this tideland acreage under the new state land leasing law.

cannot be obtained. Some lawyers have advised their oil company clients that the proceedings under which the oil has been declared forfeit were defective, some doubt the validity of the law itself. Final adjudication of the law's constitutionality has not been had, although it has been given incidental recognition by federal and state appellate courts.

Really Bought Tenders

What purchasers bought in many cases in buying back their oil were tenders. The railroad commission, under the law, is obliged to permit the oil to move once it has been sold. It can move only within the state, though, for the Federal Tender Board has taken the position all the way that nothing can be done to "hot" oil that will cool it off.

The oil has attracted the attention of many and periodically somebody shows up at the office of the railroad commission or the Federal Tender Board, claiming that Jim Farley or the White House sent him down to say that it was all right to go ahead and clear the oil for immediate shipment. Most of these visitors then try to manage for bus fare to Dallas.

Attorney General McCraw made the longest statement of anybody in the midst of last week's ruckus. He asserted that intimations and statements that his office was planning to dump all existing illegal oil were "entirely unfounded."

"The cry about confiscation is largely imaginative," he said. "All oil sold under the confiscation act since its enactment in 1935 would hardly amount to two days production in Texas. This illegal production was largely in existence before I became Attorney General. As Attorney General, I did not recommend the enactment of confiscation law but, despite its weaknesses, I have endeavored to administer the law in complete harmony with the conservation program of Texas. This I shall continue to do and no man in Texas need be disturbed for a single moment that there will be any dumping of large amounts of illegal production upon the market."

Owensboro Takings

CLEVELAND, Sept. 6.—Crude takings of Owensboro Corp. pipeline subsidiary of the Ohio Standard, from its connections in the Beecher City-Louden area of southern Illinois, are now averaging about 100 barrels daily —varying somewhat according to congestion of wells, it was learned today. The Sohio subsidiary is posting a price of $1.35 for this area.

Toledo Refinery Reopens

CHICAGO, Sept. 6.—Sixty men entered Pure Oil Co.'s refinery at Toledo, O., today to clean up preparatory to resumption of operations early next week, it was learned at Pure Oil's headquarters here. Plant was closed last May during a strike.

Oil Company's Tax Rebate

WASHINGTON, Sept. 7.—Internal Revenue Bureau has granted a rebate for overassessment in the 1932 income tax of United Gasoline Corp., Chicago, amounting to $58,885.

West Coast S. A. E. Meets

LOS ANGELES — More than 1000 members and guests from 11 western states are expected to attend the three-day program Nov. 3, 4 and 5 of the third West Coast Regional Transportation and Maintenance meeting of Southern California section of the Society of Automotive Engineers to be held at the Elks Club here. Theme of the meeting will be "Lower Over-all Operating Costs."

Oil Buyers' Failure To Do Their 'Duty' Might Bring Control

(*Continued from page* 9)
federal agency could be vested with such powers."

Jittery Over Madison

Taking up the anti-trust phase of concerted purchasing of crude, the memo points out that "the entire industry is jittery because of the Madison Indictments," adding that "no one seems to know what the law is."

If purchasers "cannot even discuss among themselves" the matter of fair ratable takings, "there then results an unfortunate situation and one that is calculated to do immeasurable public harm."

The memo suggests, however, that it would be legal for purchasers, acting as individuals, to "look at their own situations and the general situation and formulate their own independent policies to the end that they at least will have made their own individual contribution," and adds:

"The composite results of such individual action should certainly very largely bring about that degree of fair, equitable and ratable purchases which must characterize proration if the system or principle is to long endure and if the rights of the producer are to be protected."

'Buy Kansas Gasoline' Move Pushed In Sunflower State

N. P. N. News Bureau
By LAWRENCE E. SMITH

TULSA, Sept. 3. — H. A. Meyer, managing director of the Kansas Independent Oil & Gas Assn., isn't allowing any grass to grow under the association's feet in its battle to obtain a larger share of the U. S. market for crude oil. He is getting a lot of publicity and his typewriter becomes smoking hot some days.

How it will all turn out this writer is not predicting. The signs now are that the battle may get warmer as time goes on. The association, in whose membership is found most of the independent producers and refiners of Kansas and hundreds of royalty and land-owners, has the governor of the state and its corporation commission on its side.

The governor has made oration several times and said that, if other means fail, he will declare for federal regulation. The corporation commission seldom loses an opportunity, at the monthly hearings on proration, to show its displeasure at what it considers the skimpy nominations of the large purchasing companies. Nominations are the forecasts of required amounts of crude oil.

A recent letter from Meyer to Gov. Walter A. Huxman gave the governor the association's right hand of fellowship because the governor had declared for the policy of using only Kansas motor fuel in automobiles, tractors and other internal combustion engines used on state projects by contractors. This was followed Aug. 30 by a statement from the office of the association to members, saying:

"Kansas has a potential oil production of 3,458,000 barrels from 18,523 wells.

Greatly Restricted Output

"It is, however, restricted in its outlet to about 155,000 barrels daily or about 4.45 per cent.

"Kansas oil producers ask no special favors. They only ask they be accorded an equitable part of the oil market between states.

"A fair part of this market is being denied them by the persistent discrimination of certain large interstate purchasing companies against Kansas in the securing of their over-all requirements for crude oil.

"Paralleling this unfair situation the fact is to be noted that Kansas consumes over 1,000,000 gallons of gasoline daily, much of which is not made from Kansas oil.

"Those who use only gasoline and other products made from Kansas crude are helping to stimulate the demand for Kansas oil.

"The prime objective of this association is to increase the market for Kansas oil. This objective, particularly in the light of what the oil industry means to Kansas, merits the support of the state, its municipalities, all Kansans and the Kansas press."

Meyer's next job was to write a letter to William J. Armstrong, state conservation officer of Oklahoma, who had been quoted in the daily press as saying that the "big fellows" should come forward and help out in Oklahoma because "we have been leaning over a little here and there to help the industry . ." Meyer spoke feelingly to Armstrong, as follows:

Replies To Oklahoma

". . . if you think the 'big fellows' have been indifferent to your Oklahoma situation I am impelled to say that, compared to our situation here in Kansas, you folks down in Oklahoma are in clover. We feel this way for, while your production may be running under your high Bureau of Mines estimates of demand, common report has it that you are nevertheless producing about 80 per cent of capacity with many of your areas producing wide open. That would be an Utopian condition for Kansas for we are restricted in our market outlet to about 4.5 per cent of capacity to produce.

"If, despite the fact that Oklahoma, since the first of the year, has exceeded its fixed state allowable production by 2,278,976 barrels, you still feel that it has 'leaned over to help the industry' I know that you will grant that the accolade for such service to the industry should go to Kansas, for during the same period its production has been held under its fixed state allowable about 1,636,877 barrels. On such a premise I know you will appreciate why we folks here in Kansas feel that the 'big fellows' should help us too."

Turning back to the theory that Kansans should use Kansas oil products, the word "boycott" crept into print in connections with this movement. Meyer repudiates the word. It is, he says, an "admixture" of reciprocity and co-operation.

Where all this will lead, as remarked, this writer ventures no guess. It is expected that Meyer, speaking for a large group of usually outspoken Kansas producers, will continue to try to get bigger markets for Kansas oil. He is fighting on his home grounds, for he has been in the state long enough to know nearly everybody. He knows quite a lot about big companies too, for he sat on that side of the table for years.

He came to the Prairie Oil & Gas Co. after getting several years of training in administrative work as secretary to Franklin K. Lane, then Secretary of the Interior. The last years of his association with the Prairie were as assistant to the general manager. With the merger of the Prairie and the Sinclair companies into the Consolidated Oil Corp., Meyer became a vice-president of the Sinclair Prairie Oil Marketing Co. He resigned more than two years ago and engaged in business in Independence, Kans., his old adopted home town. The new Kansas oil association was formed and Meyer was selected as the man to start something on the subject of broader markets for Kansas crude oil.

Refiner Blames Price Cut On Under-the-Market Oils

(*Continued from page* 11)

price and the producer tossing in a third barrel free.

One refiner in that area for a time obtained KMA crude at the posted price at the well, but delivered to his plant. The producer absorbed the trucking cost. The trouble is, however, that most of those refiners in the North Texas area already are tied up on long time contracts with producers in other North Texas fields and the crude they are having to buy on these contracts is about all the oil they can possibly use in supplying the demand for their refined products. Accordingly, they cannot take advantage of the KMA offerings in any sizable quantities.

In southern Oklahoma the Ben Franklin Refining Co., at Ardmore is being rehabilitated to operate on crude which has been turned loose by major purchasers, and it is no secret that officials of that refinery are going to strike some good bargains with the stripper well operators who otherwise would have no market for their production.

Several refineries in Kansas have been obtaining crude oil at under the posted prices for some time, while others have been paying the posted price for their oil.

Stiff Competition Met

Of course the refined products from the plants having the advantage in crude costs and those which have had no advantage have been moving into the same general consuming area, and in many instances they have encountered stiff competition from refined oils from Michigan and Indiana plants.

Then there is another factor. There have been sizable quantities of oil along the Gulf coast which has been processed in plants in that area, the refined products cutting out some of the business East Texas and Louisiana plants formerly obtained. The latter refiners accordingly have had to look more intently at the middle western consuming areas.

Crude Cuts Discounted

It all adds up to the fact that, theoretically at least, the crude price cuts of the past 10 days long ago were discounted in the refined oils market as a result of the rather widespread "under the posted price" crude oil buying by the refiners who were fortunate enough to enjoy that privilege. The situation came to a head in East Texas first because that district was under a more severe strain, with outside oil coming in to compete in East Texas and oil from other fields steadily replacing East Texas oil in markets which heretofore had been supplied by that field.

The tank car price for gasoline in the East Texas field, meanwhile, had not been affected by the reductions in crude, up to the time this was written. Prices in some of the other Mid-Continent refining districts, however, had been affected. In Oklahoma and Louisiana, for example, gasoline prices moved down approximately 0.125 cent a gallon, while in the North Texas district the reduction was approximately 0.25 cent.

'Twas Coal To New Castle; Now, Crude to East Texas

N. P. N. News Bureau

TULSA, Sept. 3.—Crude oil from the Schuler field in southwest Arkansas in recent months has been transported to refineries in East Texas and processed right in the heart of the world's largest oil field, in competition with that field's crude. That fact has attracted considerable attention in southwestern oil circles and caused a tense situation within East Texas.

This attention has been intensified considerably in the wake of the reduction in the price schedules for East Texas crude and reductions in crude prices in some of the other southwestern fields. It is generally believed that the cheaper priced crude from Arkansas, competing with the East Texas crude in its own front yard, was a contributing factor in the recent price cuts.

Inquiries have been numerous as to what type of crude was being produced in the Schuler field—a field which is rated at present as having a daily production of 24,000 barrels, with the possibility that total will be increased along with the possibility that similar crude will be found in other areas in Arkansas. For it must be kept in mind that the Schuler crude is coming from a producing horizon deeper than any other now producing in Arkansas.

From Two "Sands"

In the first place the field is producing from two horizons. The so-called "shallow" production is coming from the Morgan sand at a depth of 5500 to 5600 feet. The "deep" production is from the Jones sand, topped at approximately 7600 feet.

The shallow production crude is the better oil, according to analysis, but to date there is not nearly as much of it as there is of the Jones sand production. The latter is classed as a "sour" crude, while the former is a "sweet" crude.

Analysis of the Morgan sand (shallow) crude shows that it has a gravity of 45.5 and contains one per cent bottom sediment and water; that it has a gasoline yield of 27 per cent, naphtha 16 per cent, kerosine 14 per cent, gas oil 31 per cent, and bottoms and losses 12 per cent.

The Jones sand (deep) crude, on the other hand, has a gravity of 32, with a viscosity at 100 degrees F. of 59 Saybolt Universal, and a viscosity of 126 S. U. at 50 degrees F. The pour point is —20 degrees F., with 0.2 per cent bottom sediment and water.

The gasoline yield is 24 per cent, kerosine 12 per cent and gas oil 39 per cent, with 25 per cent bottoms and losses.

While a sizable quantity of the Schuler crude for a time was transported to the East Texas plants for processing, reports are that most of the oil which formerly stopped in East Texas now is being transported by pipeline on to Gulf Coast plants, although there is still some Schuler oil being mixed with East Texas crude at the East Texas plants. Regardless of the fact that the Schuler crude is going to the Gulf Coast, nevertheless it is replacing some East Texas crude which formerly moved to tide water plants for processing. And of course there still is the threat that, in the event of increased production in Schuler, some of the oil again may find its way into East Texas.

Distillation Test on the Jones Sand (Deep) Crude from the Schuler Field

	Gasoline	Ker.	Gas Oil
Gravity, A.P.I.	60.0	42.8	27.0
Flash, degrees F.	...	150	240
End point, deg. F.	400	525	...
Octane number	43	...	...
Doctor & Corrosion	Neg.	Neg.	...
Pour point, deg. F.	...	...	70

Distillation Test of the Morgan Sand (Shallow) Crude From the Schuler Field in Arkansas, Which Has Been Competing, at East Texas Plants, with Crude Produced in East Texas Field

	Gasoline	Naph.	Ker.	Gas Oil
Gravity, A.P.I.	76.3	58.5	47.0	34.5
Doctor & Corrosion	Ok	Ok	OR	...
Init. Boiling Pt.	88° F.	201	335	...
10 per cent	119	248	390	...
50 per cent	175	299	429	...
90 per cent	248	364	490	...
End point	325	405	540	...
Octane, number	50	...	...	...
Lead required for 70 Octane	2.4c.c.	...	...	...
Pour test, degrees F.	...	...	...	90° F.

Saturday Shutdowns Return To Texas Oil Fields

East Texas Crude Price Is Leveled; Refiner Cuts In Southern Oklahoma

N. P. N. News Bureau

TULSA, Sept. 3. — Prospect of an increase in the amount of confiscated oil available to some refiners in Texas, from the East Texas field, was a topic of conversation this week, after the crude price reduction in that field had finally become uniform.

Proceedings at Austin, as related in another part of this issue, sales of 209,250 barrels of fuel oil to be held Sept. 6 at Tyler and Henderson and prospective sales soon of other batches caused some to believe that a large quantity of "hot" oil, made legal through court action, might soon reach the market at low prices. Attorney General William McCraw, in a public statement, disclaimed intent to endanger the industry's stability through these court proceedings.

Following the ordering of Saturday shutdowns again in Texas by the Texas Railroad Commission, to continue through September, purchasers found it possible to take up about all the surplus oil in the field — oil which either was without market for a time or promised to be in that condition. With the equivalent of two-sevenths of a week's output held back, purchasers were able to take the output of a greater number of wells. Reports at the close of the week were that few wells were without market and these mainly were of small production, far under the average allowable per well for the field.

Cut in Southern Fields

Reduction of 10 cents per barrel in southern Oklahoma fields by Rock Island Oil Co., buying subsidiary of the Rock Island Refining Co., Duncan, had not been followed by cuts on the part of other buyers. The company made its reduction as of Sept. 1, asserting that, in its marketing territory, it was having to compete with some products made from lower cost crude and crude selling below the posted price. Its purchases total about 5500 barrels daily, from such fields as Sholom Alechem, Tatums, Tussy, Comanche, Empire and Velma and several more, all in Carter and Stephens counties.

Conditions in this area have been critical for some time but were partly relieved during the week. One of the three buyers in the Healdton field had been on a 40 per cent buying program, another had announced it would prorate its connections similarly beginning Sept. 1. Pure Oil Co., however, resumed full purchases Aug. 29 and Shell Petroleum Corp., scheduled to start pipeline proration on the 1st, is continuing to purchase full production.

Pure's gathering system in the Healdton field will change hands about the middle of September, it was announced. The buyer is the Ben Franklin Refining Co., recently organized to operate the plant of the Wirt Franklin Petroleum Corp. at Ardmore, which has been idle since 1935. The refinery was bought through federal court from the trustee. Its capacity is being increased and the company expects to start running Sept. 15 or soon thereafter.

Gathering Lines Bought

Purchased from the Pure Oil Co. was the gathering system in the Healdton field, which will be connected to the trunk line which the Ben Franklin company recently bought from a Santa Fe railway subsidiary. The Pure system is connected to leases capable of making about 2500 barrels daily, but about 500 barrels of this belong to Pure and it is understood that its oil will continue to be tendered to the Oklahoma Pipe Line Co. for movement to Pure's Muskogee plant.

No other purchasers, as the week ended, had met the Humble Oil & Refining Co.'s changes in crude oil buying schedules posted Sept. 1 on numerous fields of West Texas, Texas Panhandle, Gulf Coast and South Texas. Principal effect of these was to increase the price on high gravity crudes, including the considerable amount of distillate production now in existence, by increasing the scope of the gravity schedules.

Phillips Petroleum Co., a principal producer in the Schuler field of south Arkansas, posted an 85-cent price for Jones sand crude in that field, Sept. 1. Production from this, the deeper of the two principal pay zones, now totals about 22,000 barrels daily. Up to 10,000 barrels daily is being taken by Pure Oil Co., handled in three pipeline systems, and delivered to Smith's Bluff, near Beaumont, Texas.

New Outlet Planned

A new outlet for Cotton Valley, La., oil and distillate was reported in the offing, with Atlas Pipe Line Co. and H. L. Hunt joining in building 12 miles of line to the Atlas' Gillark station, near Minden, La. Oil gathered by the Placid Oil Co., headed by Hunt, would be moved to this station, then would be taken via Texas Pipe Line Co. to Port Arthur. The Placid company now gathers about 4000 barrels daily of the field's total of 11,000 barrels.

Announcement Sept. 1 of price posting of $1.35 per barrel for crude in the Louden pool, Fayette county, Ill., by Carter Oil Co. served to direct more attention to the shallow sand area at the west side of the central Illinois coal basin. The total production of the state is now approximately 70,000 barrels daily, including some 14,000 barrels from the old fields of the southeast part of the state. Peculiarly enough, the old fields have registered an increase in output since the new ones hit their stride. The state's production now tops that of Michigan.

Rails Get Hearing On Arkansas Rates

N. P. N. News Bureau

WASHINGTON, Sept. 6. — Hearing will be held before an Interstate Commerce Commission Examiner at Little Rock, Arkansas, October 10, on the petition of railroads seeking to have orders of the Arkansas Corporation Commission refusing to grant freight rate increases on petroleum products and certain other commodities set aside.

Rails filed their petition after the state commission declined to allow the 10 per cent freight rate increase granted by ICC in March as applied to the commodities named in intrastate movements. They said that refusal of the Arkansas commission to grant the increases resulted in undue advantage for shippers in Intrastate Commerce, since the rate increases were made applicable to interstate movements.

WASHINGTON — Employment in petroleum refining was off slightly in May this year, as compared with May, 1937, but payrolls were up 3.5 per cent, according to indices of U. S. Bureau of Labor Statistics.

Technical Topics For Refinery Men Listed For W.P.R.A. Fall Meetings

N. P. N. News Bureau

TULSA, Sept. 6.—Economics involved in routine plant operations will be the theme of the third annual series of technical programs for refinery men in the Mid-Continent, L. D. Mann, of Cities Service Oil Co., chairman of the Western Petroleum Refiners Assn.'s manufacturing committee, has announced.

The committee, which sponsored these meetings in the fall of 1936 and 1937, has announced that the first meeting this fall will be held at the Allis hotel, Wichita, Kan., Sept. 29. The second meeting will be held approximately a month later — Oct. 28 — at the Washington-Youree hotel in Shreveport.

Papers Scheduled

Chairman Mann has announced the following program for the Wichita meeting:

"Reclaiming Refinery Materials", by E. R. Jones of the Skelly Oil Co., El Dorado, Kan.

"Safety Economics Pertaining to Refineries", by Henry W. Boggess, safety engineer for Sinclair Prairie Oil Corp., Tulsa.

"Cracking to Fuel Oil vs. Cracking to Coke," by George B. Murphy, Universal Oil Products Corp., Chicago. Plant men will be taken for a tour of the refineries in the vicinity of Wichita, following the meeting. Several new improvements have been installed at the refineries in and near Wichita in the past year and those improvements will be made available for inspection.

At the Shreveport meeting the following program will be presented:

"Furnace Walls and Arches," by a representative of the Ditrick Arch Co.

"Modern Engines and the Demand on Refiners for Motor Fuels", by W. W. Scheumann, Cities Service Oil Co., Tulsa.

"Lubricating Oils From Mid-Continent Crudes", the author to be announced later.

Mid-Continent 'Gas' Output Was Increased During July

N. P. N. News Bureau

TULSA, Sept. 6. — Gasoline production in July at the 53 Mid-Continent refineries reporting monthly operations to the Western Petroleum Refiners Assn. was 278,920 barrels higher than in June. On a daily average basis this amounted to an increase of about 1000 barrels when allowance is made for the 31-day month of July.

While gasoline output in July was higher than it was in June, production in the former month nevertheless was 334,676 barrels under the production for July, 1937.

Gasoline shipments in July were 303,266 barrels under those for June, and 904,277 barrels under shipments for July, 1937. Stocks were reduced 540,632 barrels in July, but still were 570,280 barrels higher than they were on July 31, 1937.

Kerosine production in July exceeded June's total by 47,004 barrels, while shipments were 13,939 barrels higher. Stocks increased 74,805 barrels.

Tractor fuel production was 10,424 barrels higher in July, with shipments 4650 barrels higher. Stocks were lowered 42,753 barrels.

Furnace and gas oil stocks increased 162,769 barrels in July, with production having shown a 52,297 barrels increase with shipments dropping 26,518 barrels.

Fuel oil shipments in July were only 1712 barrels higher than in June. With production reduced 37,380 barrels, stocks increased 249,964 barrels.

The accompanying table shows production, shipments and stocks of the principal refined products for June and July.

GASOLINE

(Figures in Bbls.)

Month	Prod.	Ship.	Stocks*
July	7,772,482	8,313,119	7,576,398
June	7,493,562	8,616,385	8,117,030
Change	+278,920	—303,266	—540,632
July, 1938	7,772,487	8,313,119	7,576,398
July, 1937	8,107,163	9,217,396	7,146,678
Change	—334,676	—904,277	+570,280
KEROSINE			
July	612,628	537,823	639,851
June	565,624	523,884	565,046
Change	+47,004	+13,939	+74,805
TRACTOR FUEL			
July	276,089	318,842	199,366
June	265,665	314,192	242,119
Change	+10,424	+4,650	—42,753
FURNACE AND GAS OIL			
July	394,890	234,121	1,177,185
June	342,593	260,639	1,014,416
Change	+52,297	—26,518	+162,769
FUEL OIL			
July	1,772,081	1,522,117	2,945,709
June	1,809,461	1,520,405	2,695,745
Change	—37,380	+1,712	+249,964

*End of month.

Crude Price Changes

PITTSBURGH — Effective Sept. 1 Joseph Seep Purchasing Agency reduced prices for Pennsylvania grade crude 12 cents. On Sept. 3 it reduced Corning (Ohio) crude, 10 cents, to new price of $1.07 per barrel.

Seep Agency's new prices are for Pennsylvania grade crude: in Southwest Pennsylvania lines, $1.34; in Eureka lines (West Virginia), $1.28; in Buckeye lines (Macksburg, O.), $1.18.

Other purchasers made similar reductions. These were Tide Water Associated Oil Co., which reduced Bradford-Allegany district crude 12 cents, to new price of $1.68 in Tide Water lines; and The Pennzoil Co., which reduced crude in National Transit lines, 12 cents, to new price of $1.61 for Cochran, Franklin, Hamilton and Doolittle, and ranging down to $1.56 for other lower district crudes.

Last previous change on Pennsylvania crude was a 25 cent cut June 13 last.

* * *

TULSA—Dates of the various major purchasers' price reduction on East Texas crude, which brought the price to $1.25 per barrel, were: Aug. 29, Gulf Oil Corp., Humble Oil & Refining Co., Shell Petroleum Corp., and Stanolind Oil Purchasing Co.; Aug. 30, Sinclair-Prairie Oil Marketing Co., The Texas Co., and Tide Water Associated Oil Co.; Sept. 1, Magnolia Petroleum Co. and Sun Oil Co.

Southern Oklahoma Cut

DUNCAN, OKLA.—Effective Sept. 1 Rock Island Refining Co. reduced prices of southern Oklahoma crude it buys, in Carter, Garvin and Stephens counties, 10 cents. Its new prices in these counties range from $0.65 for 20-20.9 gravity up to $1.20 for 40 and above. It posts a 4-cent differential for each grade to 25-25.9 inclusive; 3 cents for each grade from 26-26.9 to 30-30.9 inclusive; and 2 cents each grade from 31-31.9 to 40 and above.

One other Independent refiner, the Kanotex Refining Co., since June 16, 1938, has been posting a price 15 cents below Standard Oil Co. (Indiana) and other major purchasers for Oklahoma-Kansas crude it buys.

"Bill" Lowe Loses Appendix

TULSA, Sept. 6.—William F. Lowe, executive secretary of the Natural Gasoline Assn. of America, underwent an emergency operation for appendicitis Sept. 5 at Morningside Hospital here.

Another Drop Shown In Penn Lube Stocks

N. P. N. News Bureau

WASHINGTON, Sept. 7.—Inventories of the major lube items from Pennsylvania crude continued downward in the seven-day period ended Sept. 1, according to report of the National Petroleum Association today.

Stocks of bright stock decreased 430,414 gallons; 142-180 vis. neutral, 163,478 gallons; and 180 and above vis. neutral, 530,159 gallons.

Inventories of 600 steam refined stock increased 96,790 gallons, while stocks of other steam refined were down 195,079 gallons.

Standing at 16,241,694 gallons on Sept. 1, inventories of bright stock were 7,807,222 gallons, or 32 per cent, lower than the 1938 peak of 24,048,916 gallons reached on May 5. Stocks of all viscous neutrals as of Sept. 1 also were down 5,189,485 gallons, or 25 per cent, from their 1938 peak of 20,656,603 gallons reached on June 2.

Comparison of inventories on Aug. 25 and Sept. 1, as compiled by the N. P. A. from reports of all companies which refined Pennsylvania crude oil, follows:

	Aug. 25 Gallons	Sept. 1 Gallons
1. Raw Long Residuum (Including all raw long residuum below, and not salable, as 600 fire)	2,151,943	1,647,046
2. 600 Steam Refined (Includes all steam refined stock commonly sold or used as 600 and as raw material for bright stocks)	8,337,358	8,434,148
3. Other Steam Refined (Not included in 1 and 2 above)	7,024,781	6,829,702
4. Finished Dewaxed Long Res.	2,229,411	2,231,017
5. Bright Stock (Does not include any material reported in 4, above)	16,672,108	16,241,694
6. Viscous Neutral, below 180 vis. but not below 142 vis. @ 100	7,916,232	7,752,754
7. Viscous Neutral, 180 vis. @ 100 and above	8,244,523	7,714,364

Latest Daily Crude Oil Production, Important Districts and Total U. S.

(*American Petroleum Institute figures*)

	Week Ended Sept. 3 Barrels	Aug. 27 Barrels	July 30 Barrels
Oklahoma City	95,900	96,750	101,650
Total Oklahoma	432,400	437,050	422,600
Kansas	161,200	165,350	154,000
East Texas	441,650	441,200	439,600
Total Texas	1,387,300	1,395,150	1,392,150
Total Louisiana	266,450	267,300	269,450
S. Ill. (new pools)	61,950	59,600	40,000
California	651,800	674,000	650,700
East of Rockies	2,697,300	2,714,500	2,665,700
Total U. S.	3,349,100	3,388,500	3,316,400
Crude Imports	63,570	66,000	72,140
Total New Supply	3,412,670	3,454,500	3,388,540

Oil Statistics at a Glance

CRUDE PRODUCTION: U. S. daily average, week ended Sept. 3, totaled 3,349,100 barrels, a drop of about 40,000 barrels from previous week. Normally increased runs from leases the first of the month offset for this week the effect of the new Saturday shutdown in Texas.

CRUDE RUNS TO STILLS: For week ended Sept. 3 averaged 3,195,000 barrels daily, down 60,000 barrels from previous week and 255,000 barrels under same week last year.

GASOLINE PRODUCTION: Up 85,000 barrels at plants reporting to A. P. I.

GASOLINE STOCKS: Totaled 70,514,000 barrels on Sept. 3; down 1,240,000 barrels from Aug. 27, and down 22,678,000 barrels (24.3 per cent) from 1938 peak.

GAS & FUEL OIL STOCKS: Up 720,000 barrels to 147,646,000 barrels on Sept. 3.

* * *

Gasoline Stocks Slashed, Reaching Nine-Month Low

N. P. N. News Bureau

NEW YORK, Sept. 7.—Stocks of gasoline reached their lowest level in nine and one-half months and the gap between 1938 and last year's inventories continued to narrow in the week ended Sept. 3 when withdrawals from storage totaled 1,240,000 barrels, according to report of the American Petroleum Institute today.

Daily average crude runs to stills were down 60,000 barrels last week, while gasoline production of refiners reporting to the Institute increased 85,000 barrels and stocks of gas and fuel oils rose 720,000 barrels.

The Institute's estimate of total U. S. gasoline stocks fell to 70,514,000 barrels on Sept. 3. This was only 3,896,000 barrels above stocks on Sept. 3, 1937 and was within half-million barrels of the level which the Bureau of Mines had estimated that stocks would reach on Sept. 1.

The 70,514,000-barrel level of stocks on Sept. 3 is particularly noteworthy in that it represents a decline of 22,678,000 barrels, or 24.3 per cent, from this year's peak of 93,192,000 barrels reached on March 19.

Five Districts Cut

Five districts reported substantial cuts in gasoline production last week, the cuts ranging from 22,000 barrels in the Inland Texas district to 62,000 barrels in the Texas-Gulf district. Oklahoma-Kansas-Missouri production was down 55,000 barrels.

There was a sharp jump, 160,000 barrels, in East Coast gasoline production, and 62,000 barrels in California, however, which effected the net increase of 85,000 barrels in production of reporting refiners for the country as a whole.

Indiana-Illinois-Kentucky refiners took more than 500,000 barrels of gasoline from storage. East Coast stocks dropped 412,000 barrels; California stocks, 379,000 barrels; and Louisiana-Gulf stocks, 122,000 barrels.

Inventories in the Texas-Gulf district, on the other hand, rose 338,000 barrels, and inventories were up 195,000 barrels and 127,000 barrels in the Inland-Texas and Oklahoma-Kansas-Missouri districts, respectively.

Stocks of gas oils and distillates neared the 30,000,000-barrel mark when they increased 198,000 barrels last week. Inventories of residual fuels increased 522,000 barrels; half of the increase was in California.

ICC Will Examine State Truck Rules

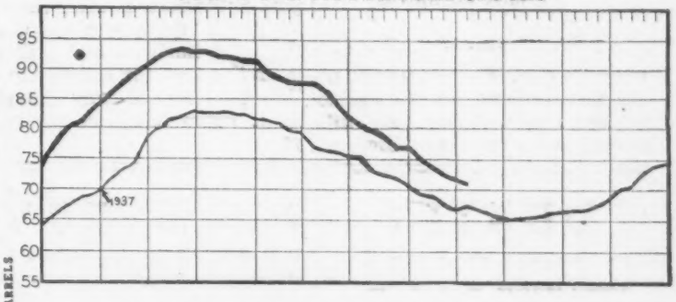
N. P. N. News Bureau

WASHINGTON, Sept. 6. — Governors of the 48 states have been sent questionnaires by the Interstate Commerce Commission in connection with the commission's investigation into need for federal truck size and weight regulation.

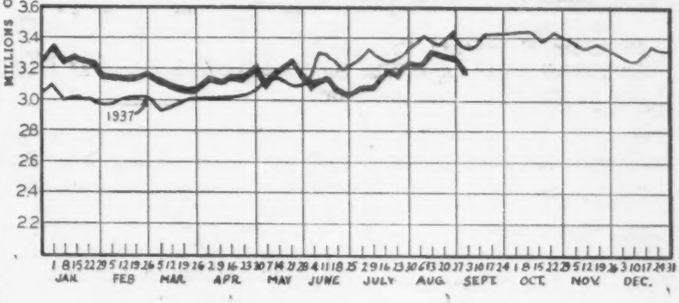
Information was requested concerning existing state limitations, maximums permitted under all conditions, the extent to which state political subdivisions may and do prescribe limitations, and any recent changes in limitations.

In addition, the commission asked information with respect to the adequacy of existing limitations, "having in mind such matters as highway safety, protection of roads and bridges, and carriers' operating costs and ability to render service."

TOTAL U. S. MOTOR FUEL STOCKS



DAILY AVERAGE CRUDE RUN TO STILLS



CURRENT REFINERY OPERATIONS

(Figures in Thousands of Barrels of 42 Gallons Each)

Districts	Per Cent Capacity Reporting	Daily Average Crude to Stills, Week Ended Sept. 3	Daily Average Crude to Stills, Week Ended Aug. 27	Per Cent of Reporting Capacity Operated, Week Ended Sept. 3	Per Cent of Reporting Capacity Operated, Week Ended Aug. 27	(a) Gasoline Production, Week Ended Sept. 3	(a) Gasoline Production, Week Ended Aug. 27	Stocks Total Finished and Unfinished Motor Fuel(b), Week Ended Sept. 3	Stocks Total Finished and Unfinished Motor Fuel(b), Week Ended Aug. 27	Stocks of Gas and Fuel Oil, Gas Oil and Distillates, Week Ended Sept. 3	Stocks of Gas and Fuel Oil, Gas Oil and Distillates, Week Ended Aug. 27	Stocks of Gas and Fuel Oil, Residual Fuel Oil, Week Ended Sept. 3	Stocks of Gas and Fuel Oil, Residual Fuel Oil, Week Ended Aug. 27	Total, Week Ended Sept. 3	Total, Week Ended Aug. 27
East Coast	100.0	506	505	82.3	82.1	1,538	1,378	19,627	20,039	6,446	6,420	8,214	8,127	14,660	14,547
Appalachian	85.9	102	105	79.7	82.0	401	361	3,681	3,038	227	221	764	792	991	1,013
Ind., Ill., Ky.	89.0	398	407	81.9	83.7	1,650	1,675	10,638	11,143	3,697	3,596	5,678	5,748	9,375	9,344
Okla., Kans., Mo.	81.6	270	276	78.9	80.7	(c)987	(c)1,042	6,352	6,205	1,125	1,134	3,256	3,209	4,381	4,343
Inland Texas	50.3	112	129	70.4	81.1	497	519	1,716	1,911	360	353	1,566	1,528	1,929	1,881
Texas Gulf	88.9	772	793	92.1	94.6	2,456	2,518	10,098	9,760	5,513	5,467	8,036	7,777	13,549	13,244
La. Gulf	97.1	119	121	87.5	89.0	335	362	2,126	2,248	1,184	1,174	2,077	2,181	3,261	3,355
No. La., Ark.	55.0	38	38	69.1	69.1	110	115	488	531	275	279	591	581	866	860
Rocky Mt.	54.2	51	58	79.7	10.6	223	236	1,241	1,283	122	115	716	709	838	824
California	90.0	510	506	68.5	67.9	1,427	1,333	11,627	12,006	10,296	10,288	84,500	84,237	94,796	94,525
Total Reporting	85.5	2,878	2,938	80.7	82.3	9,624	9,539	66,974	68,164	29,245	29,047	115,401	114,889	144,646	143,936
Estimated U. S. Total (Bur. of Mines)		3,195	3,255					70,514	71,754	29,945	29,747	117,701	117,179	147,646	146,926

(a) Includes straight-run, cracked, and natural blended.
(b) Includes stocks at refineries, in bulk terminals, pipe lines and in transit.
(c) 12% of reporting capacity in this district did not report gasoline production.

Fight On Tidelands 'Grab' Is Carried To Nova Scotia

N. P. N. News Bureau

LOS ANGELES, Sept. 3. — California oil interests, determined to enlist all possible aid in the fight to prevent federal "expropriation" of tidelands, prepared to take active part in the American Association of Port Authorities convention at Halifax, Nova Scotia, September 14 to 16.

United Landowners Ass'n., recently organized to prevent federal "grab" of California tidelands, will seek to join with delegates from Texas and Louisiana in an effort to gain support of the A. A. P. A. to fight any revival of the Nye resolution in Congress next January.

It was announced that Irwin M. Stevens, president of the Long Beach, California, harbor board, and a national director of the A. A. P. A., will lead the campaign at the convention against the proposed reintroduction of the Nye resolution.

"Although the fight has become concentrated somewhat upon California, any attempt of the federal government to seize oil bearing tidelands here will strike a disastrous blow at every coastal state in the union", Stevens said. "In Texas, the state school department functions largely upon revenues derived from its oil bearing tidelands; in Louisiana, the state is vitally concerned in its oil properties; and in all other states the seizure would likewise affect ownership of all shoreline property because of clouds thrown upon property rights.

"Reintroduction of the Nye resolution would not only throttle all future development of harbors at every port in the United States, but definitely throws into jeopardy the millions of dollars now invested in harbor improvements."

Rush M. Blodget, on the executive council of United Landowners, and executive vice-president of the Oil Producers Agency of California, will be present at the convention of port authorities to offer the picture as it affects interests other than the harbors, and will explain the need for immediate action to forestall any government move early in the next year.

DEATHS

Thomas W. Cahill

NEW YORK, Sept. 6.—Thomas W. Cahill, 40, formerly of Milwaukee and for tht past 12 years associated with Pan American Petroleum Co., died Aug. 30 at Sheboygan, Wis. He was Tennessee manager for Pan-Am with headquarters at Memphis at time of his death, reported to have been due to infection developing after he was clawed by a circus lion while on his vacation.

W. J. Wyatt

DALLAS — W. J. Wyatt, founder and president of the Wyatt Metal & Boiler Works, manufacturers of refinery equipment, died in Dallas Aug. 26. He was 68 years old. Surviving are his widow and two daughters.

Valvoline Hearing Set

WASHINGTON, Sept. 6.—Sept. 15 has been tentatively set as the date for hearing in the Federal Court at Pittsburgh, Pa., on Valvoline Oil Company-s suit for an injunction to restrain Interstate Commerce Commission from enforcing its pipeline valuation orders as applied to Valvoline's pipeline properties, it was said at ICC today. Valvoline contends its pipeline operations are not interstate common carrier in character, and hence not subject to the ICC orders.

Taxes, Regulation Theme of Oil Meet

DENVER, Sept. 3.—A "problem" clinic which will dissect the oil industry's problems of taxation and regulation, will feature the 1938 annual convention of the Colorado Petroleum Industries Committee, to be held Oct. 5 at the Shirley-Savoy Hotel here, according to George Douglas, secretary.

Principal speaker will be Baird H. Markham, director of the American Petroleum Industries Committee, New York.

W. E. Thomas, chairman of the state committee, will deliver the address of welcome and outline policies and objectives of the organization. W. H. Ferguson, Rocky Mountain regional chairman, will also speak.

A banquet, stage show and dancing will complete the day's session.

Petroleum industries committees have been organized in the various counties and a large attendance is anticipated, Douglas said.

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TOMORROW'S REFINING

THE petroleum refining industry, which in the past several years has written a dramatic chapter in the story of industrial achievement in this country, through supplying constantly improved products at lower prices to the public, is now rising to new heights under the double spur of demand for still more highly improved products and of a narrower operating margin from which to furnish those products.

The refinery of tomorrow, it becomes more apparent, will possess even more highly specialized products, selecting those for which the demand in its territory will insure the best returns. That refiners are alive to the needs of the present situation is seen in their estimates, as compiled by N.P.N. Refining Technology, that over $200,000,000 will be spent in plant improvement in the coming nine to twelve months.

To aid the refiner in the new complex problems he faces because of the economic situation in the oil industry, he has at his call a greater variety of methods and processes, to fit his individual needs, perfected and improved to a greater degree than ever before, and now offered to him at lower licensing rates than ever previously, at least in the case of the principal cracking processes.

Further to help the refiner in meeting tomorrow's demands, he can call on new metals and alloys, to go into equipment to meet the greatly increased temperatures and pressures at which he must work, and upon research work being carried on by the refinery engineering and equipment companies.

Those of us who write for Refining Technology have been inspired by the glimpses into tomorrow, and beyond, as to how the refining companies will meet the increasing demands upon them under highly complex conditions—which have been given us from many sources. In the following pages we have told this story of Tomorrow's Refining, in the belief that the men engaged in refining today will find in these pages not only helpful information but also inspiration as to the future opportunities in this branch of the oil industry.

Specialized Refining I

Refiners, To Operate Profitably, Will Make the Particular, Relatively Higher Priced Products They Can Market Best: Processes and Equipment Are Now Available to Help Them Rebuild to That End

By ARCH L. FOSTER

N. P. N. Technical Editor

REFINERS in this country will spend at least $200,000,000 in the coming 12 months in capital improvements, the impetus being the two-pronged spur of the need for improving the quality of their products and the necessity for reducing their refining costs. This estimate is supported by a company-to-company canvass just completed.

In addition to this amount, large sums will be spent for maintenance and replacement in processes where the service life is relatively short.

To a greater degree than ever before in the history of the industry, the refiners, in investing these capital sums, will have their choice of processes and equipment to meet their particular manufacturing requirements.

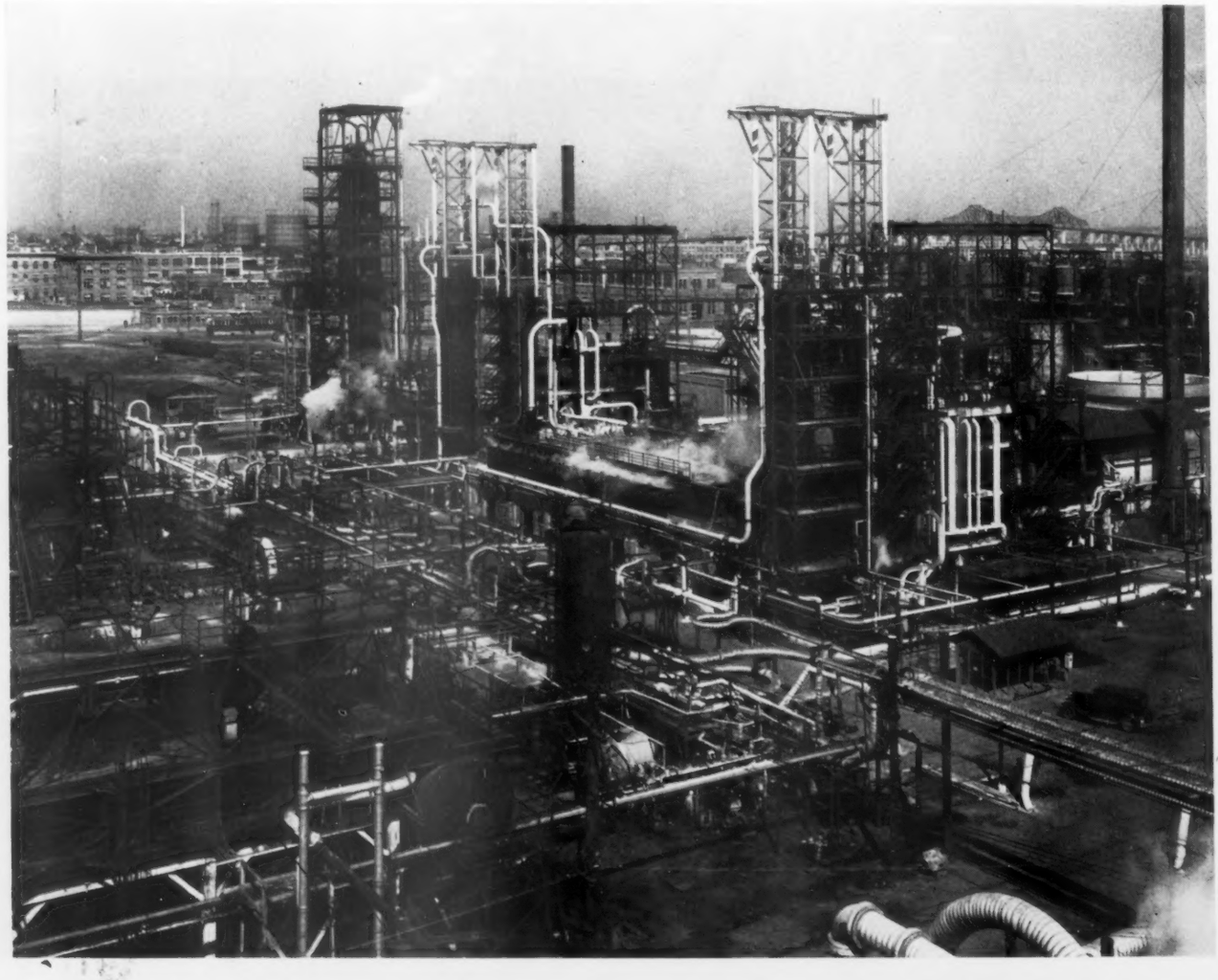
The refiner today is becoming a producer of specialized products and the processes for making these products have long since emerged from the rule-of-thumb cocoon and today are based on the best chemical and engineering knowledge, the results of long years of research. The major problem of the refiner is making his selection of process and equipment that best fits his individual needs.

To stimulate immediate plant rebuilding, the refiner today has the advantage of lower steel costs, his largest single cost item after labor and engineering. Some authorities put the saving in plant rebuilding of steel alone at five per cent, as compared with costs several months ago.

The lower cost of obtaining capital by borrowing, stock or bond sales, by sound, reputable companies will also give impetus to refinery rebuilding in the immediate future. Some of the larger oil companies have already raised large sums, at low interest rates, to finance their capital expenditures, in part for plant rebuilding.

The present outlook for the refinery rebuilding program for 1939 illustrates a fundamental fact as old as industrial development. Necessity may be the mother of

Only the draftsman knows the complexities of the piping and lines of a modern refinery. A crude topping and cracking unit at the Bayway plant of Standard of New Jersey



Is Means to Profits

invention; but adverse business conditions, product improvement demands created by competition and diminishing profit margins are the taskmasters which force industry to adopt and use these inventions.

This estimated expenditure of $200,000,000 in capital improvements in plants, difficult as it is to visualize, is the direct result of two major trends, or two phases of the continuing trend in industrial progress. The prime mover in this trend, as in all such tendencies, is the ever present need to improve the quality of refined products. Octane number requirements of the market continually rise. Gum deposition is a bothersome thing and the refiner eternally works to decrease this objectionable quality of motor fuels. Specifications for diesel oils, fuel oils, and lubricants are being drawn to call for products more carefully tailored to the specific need.

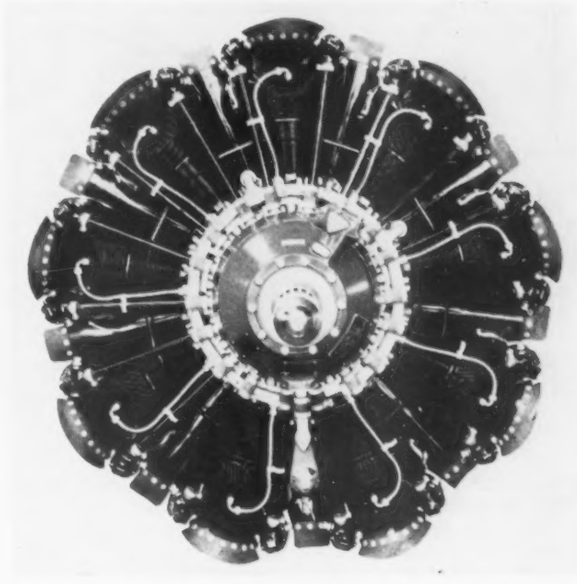
With an artificially maintained high price for crude (high in comparison to the prices for finished products obtained during the last seven or eight years), with unrestricted competition holding down retail and refinery market prices to low levels over most of that period), not only ever-increasing yields of the higher-priced products are imperative if the refiner is to survive—but also lower refinery operating costs, and the trend in this direction is the second major phase of the refiner's present economic situation.

THE factors which have forced and are still forcing the refiner to gird his loins to do battle with the causes of his always-decreasing operating margin are not so complicated as to make it difficult for the average man to read the answer; but the process of changing these factors to enable the refiner to stay "in the black" or to reduce his losses to the vanishing point *is* difficult. It involves the expenditure of uncounted millions in research, the maintenance of staffs of chemists, engineers, physicists and other technologists wide in experience and with the training and the type of mind which can concentrate on a half test tubeful of an unknown substance which becomes carload lots in a relatively short time.

It is only very recently that the oil industry became actually research-minded. The attitude of 20 years ago is typified by a remark made to the writer in the period immediately following the World War, by a man in charge of such "research" as his company would undertake. "We are interested in no problem which requires more than 60 days to complete!" That same company now has one of the largest and best equipped laboratories, in both apparatus and staff, in the country. The attitude of that former day is expressed in the formula of one of the old hard-handed oil prospectors, whose one technical order to his crews was " Git Ile!"

That period has passed; the men and the rule-of-thumb methods they used are likewise passing, swiftly and in many cases unfortunately. Industrial progress is identical with natural evolution; the law of survival of the fittest is an inexorable one and well the informed oil man knows it. The oil company which does not take advantage of the results of research, either that of its own staff or by license from other development organizations is assuming a difficult handicap. This is for the simple reason that the knowledge of research and application of its results is what constitutes the "fittest" in Darwin's memorable law. And *natural* laws cannot be lobbied out of the Great Engineer's statute book.

As a background for discussion of what is going on



Aviation super-fuels of 100 octane number are being made in greatly increased quantity to supply engines such as this 9-cylinder Wright engine, which turns up between 800 and 900 H.P. Newer engines, two rows of seven cylinders each are being built of this type, turning up 1500 H.P. or more, designed to operate on 100 octane number fuels. The Army and Navy Air Corps will use up to a million barrels of such fuels during the fiscal year 1939, it is estimated

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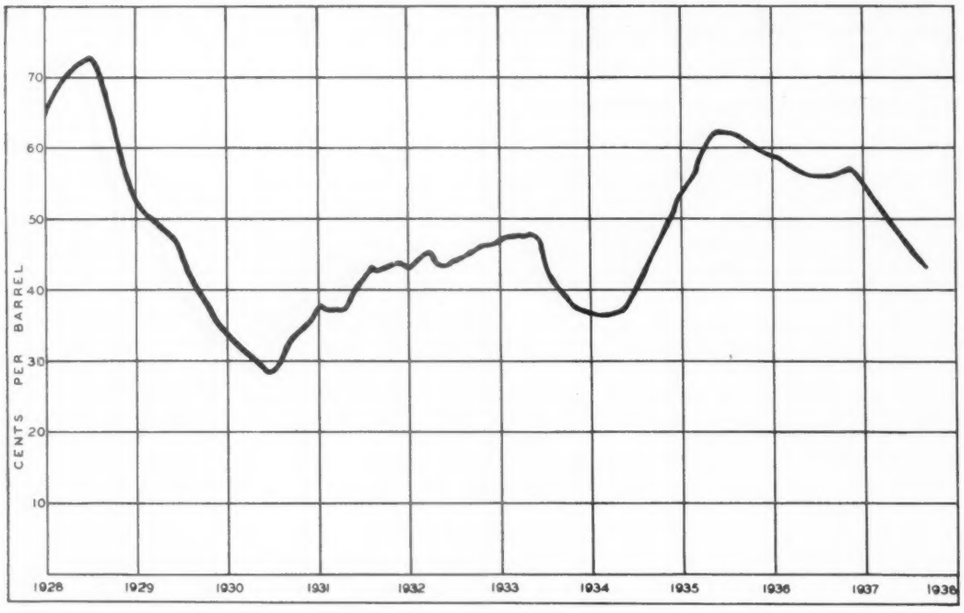

The Mid-Continent refiner's operating margin, 1928-1938, in cents per barrel of crude processed. Seasonal changes have been eliminated by using a 12-months' running average figure in plotting the curve. Any point on the curve is the average of the preceding 12 months

now and what bids fair to continue with increased velocity in the immediate future, investigate what the refiner has done to supply an always increasing amount of motor fuel of rising quality, without leaving impossible surpluses of other products normally producible from crude.

Since 1929 refiners have increased their production of cracked gasoline by more than 85%. Their purpose was two-fold; to produce the required amount of motor fuel from the available amount of crude, to raise the octane number, and improve the volatility, and other characteristics of the product marketed. At the same time the straight-run gasoline production was increased by only 2%, or about the same ratio as the increase in crude run to stills. To all intents and purposes this increased yield is the result of one intensive research program — on cracking. More recently polymerization, hydrogenation, and some other developments have come into the picture but their contribution is more technical and quality advantage than volume increase.

The trend in octane number of motor fuels is slowly but definitely upward and has been so for several years. Since 1929 the average has increased from little better than 60 to 70-72, the maximum in later years being "fixed" by the Q-gasoline standard. Recent reports shows that in some sections the rating for regular gasoline ranges between 72 and 75, L-3 method. New processes and the force of competition will undoubtedly force this value slowly but surely upward. In aviation fuels, preliminary figures show the Army and Navy will use up to 1,000,000 barrels of 100 octane number fuel in 1939.

A 1938 summer survey of octane numbers of motor fuels sold by major marketers in the midwest area shows that, out of 36 samples tested, 25 had octane numbers above 70, ASTM Motor Method, which agrees approximately with 72, L-3 Method. These fuels ranged from 68.7 as the lowest (one sample), 69.5 (two samples) to 71.5 (8 samples) with one reaching 72.5 ASTM. While this increase above the 70 ASTM maximum is small, consistently high ratings from a number of samples indicates definitely that the trend is slowly upward. Also, the midwest has never been the area which markets the highest octane number fuels, the East and West Coasts holding the palm in that quality. Sales competition appears to be forcing this slow rise, rather than any essential demand on the part of the automotive engine.

More recently the accumulation of heavy fuel oils in the industry's tanks, and the consequent degradation of their prices has caused the refiner to scout for means and processes to reduce this growing burden. Since 1929 fuel oil production has increased only 1.4%, while over-

TABLE 2—Gasoline Demand, Production and Stocks, 1929-1938. From U. S. Bureau of Mines Reports

(Figures in Thousand Barrels)

Year	Demand	Production	Stocks
1929	375,999	439,393	43,261
1930	394,800	440,728	40,098
1931	403,418	437,453	55,226
1932	373,900	399,712	54,310
1933	377,003	407,932	59,935
1934	410,339	423,801	51,747
1935	434,810	468,021	54,345
1936	481,606	516,266	60,437
1937	518,760	570,979	74,650
1st half			
1937	243,730	274,527	73,866
1938	244,754	274,697	80,676

TABLE 1—Fuel Oil Demand, Production and Stocks, 1929-1938
From U. S. Bureau of Mines Reports

(Figures in Thousand Barrels)

Year	Demand		Production		Stocks (Dec. 31)		Sales
	Gas Oil & Distillate Fuel Oil	Residual Fuel Oil	Gas Oil & Distillate Fuel Oil	Residual Fuel Oil	Gas Oil & Distillate Fuel Oil	Residual Fuel Oil	Gas Oil Fuel Oil Range Oil
1930	.....	.....	81,551	290,947	16,390	121,400	401,210
1931	334,669		83,882	253,085	18,526	117,330	362,917
1932	308,157		69,467	225,283	14,110	115,776	328,405
1933	316,344		78,920	237,519	16,315	106,689	339,179
1934	340,371		94,972	240,381	21,957	88,440	374,682
1935	86,028	280,695	100,235	259,826	19,930	84,054	416,459
1936	102,757	307,884	125,906	287,968	22,813	84,236	470,584
1937	117,377	324,437	146,706	310,161	22,566	95,019	.....
First Six Months							
1937	57,500	165,269	68,450	148,588	20,657	81,224	.....
1938	55,120	142,171	72,835	147,384	24,699	95,690	.....

DE-SALTING *assures* VAST SAVINGS IN REFINERY OPERATIONS

Petreco Electromatic De-Salting Plants are an integral part of many of the modern refineries recently built and now under construction. The six-unit Petreco installation shown below is a typical example.

These Petreco plants are eliminating many of the obstinate refining difficulties traceable to salts in crude charging stocks; increasing on-stream time as much as 1000 per cent in some instances; reducing repair, replacement and overall operating costs to minimum; and greatly improving the quality of asphalt and fuel oil.

The story of Petreco Electromatic De-Salting in modern refinery operations will prove intensely interesting and valuable to refinery operators. Complete details, as well as performance and cost data, will be supplied without obligation.

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General Offices: 530 West Sixth St., Los Angeles, Calif.
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Representatives in Principal Oil Fields and Refining Centers

PETRECO
Electromatic **DE-SALTING PROCESS**

all gasoline production has risen 30%. The cause of the accumulation of fuel oil stocks is the reduction in consumption of fuel oil by industry in general. Demand for all fuel oils in 1931 was, from Bureau of Mines figures, 334,669,000 barrels.

While in 1937, demand for all fuel oils was larger all told, at 441,814,000 barrels, the consumption of distillate fuels, furnace oils, diesel fuel and so on has increased very greatly, as compared with 1931 and earlier years, and industrial fuel oil consumption has lagged. This is particularly true in 1938.

While economists believe with good reason that fuel oil consumption will inevitably increase as industry becomes more active, it seems obvious that the demand will lag behind production if the latter is increased or probably even if maintained at its present level. So the refiner must look for means of disposing of his surplus fuel oil as a different product, the total demand for which is less saturated, or the price of which is at least equal to the cost of production.

The most obvious way out for the refiner is to convert residual fuel oils to coke. Petroleum coke, because of its very high carbon content, practical absence of ash and high thermal value is a desirable domestic and industrial fuel. Its total heat value is between 15,000 and 16,000 B.t.u. per pound, as compared to slightly more than 13,000 B.t.u. for coal coke with its greater ash content, and 13,000 to 15,000 B.t.u. for coal. Much of petroleum coke is now used in the electrical and other industries. Newer methods of operating coke-producing cracking stills result in a coke, the physical properties of which recommend it to the domestic and the industrial user. Many technologists agree that the field is open for further development of coking processes.

A far greater positive advantage by coking fuel oil is the increased yield of motor gasoline obtained. Present-day figures show that an increase of about 15% of the gasoline made when running to heavy fuel oil may be obtained when running the total charge to coke, with the same octane number gasoline in each case.

For example, assuming a charge stock of 25.0 A.P.I. gravity Mid-Continent topped crude, a typical yield determined from first-hand data is 53% of 400 E. P. gasoline, when running to 300 Furol seconds viscosity Bunker C fuel oil. When run to coke, this same stock will produce 68% of the same quality endpoint gasoline, an increase of 15% of the topped crude, a yield not to be taken lightly.

Assuming for calculation purposes that 25% of straight-run gasoline and 10% kerosine distillate was removed from the raw crude before cracking, the total gasoline yield when producing fuel oil would be 59.4% of the crude. When coking is practiced the yield would be 69.2% of the crude, or practically 10% more yield of the highest priced fuel produced in the refinery for the regular market. Under high crude prices, the refiner can well afford in most cases to sell at a nuisance value to obtain this yield advantage. Note that these figures are based on the same quality of product.

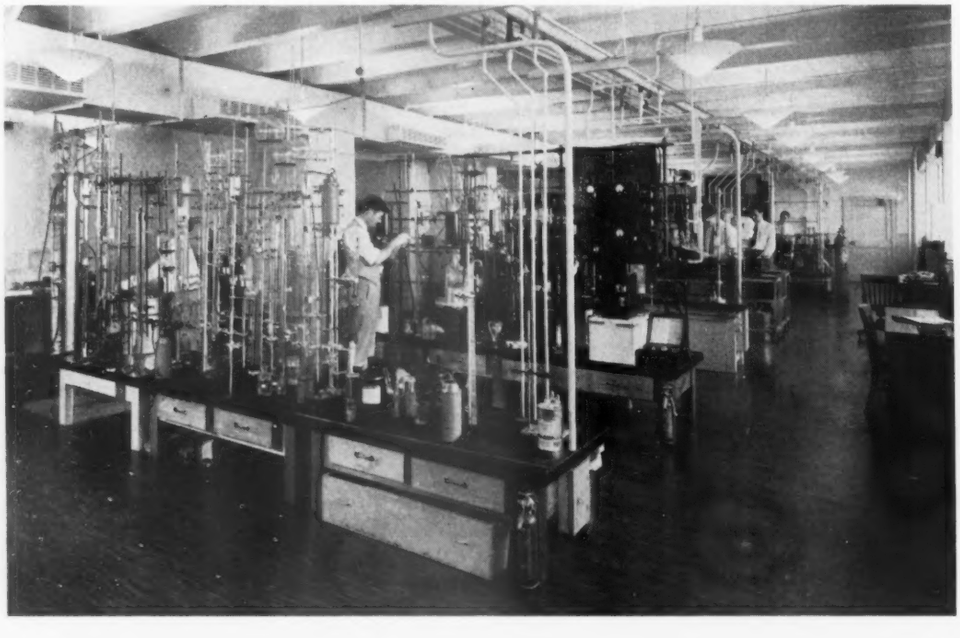
This type of operation then is the most obvious method for reducing overall fuel oil production to a figure which will maintain a reasonable price for it. Many refiners now and for years in the past have so operated as to either produce fuel oil or to run to coke, as market conditions showed good or bad prices for heavy fuel. Conversion of a non-coking installation to one which can produce coke economically is, by present methods, chiefly the matter of adding coking or reaction chambers in parallel with the original chamber with which most cracking units are provided. The Knowles coke oven is used in a few installations. Conversion of fuel oil to road oils, asphalt, and so on, has some advantages but numerous disadvantages which make that solution far from perfect for general application. A new development for removing coke from the chamber quickly, by means of a high pressure water stream, reduces costs considerably.

CO-ORDINATED with the need for increasing yields comes the parallel necessity for reducing plant losses. Selling heavy fuel at a price below that which is economic in terms of its production cost and/or its thermal value is a loss. Converting it to gasoline, polymerizable gas, and coke, if intelligently handled, can eliminate much of that loss, say refiners.

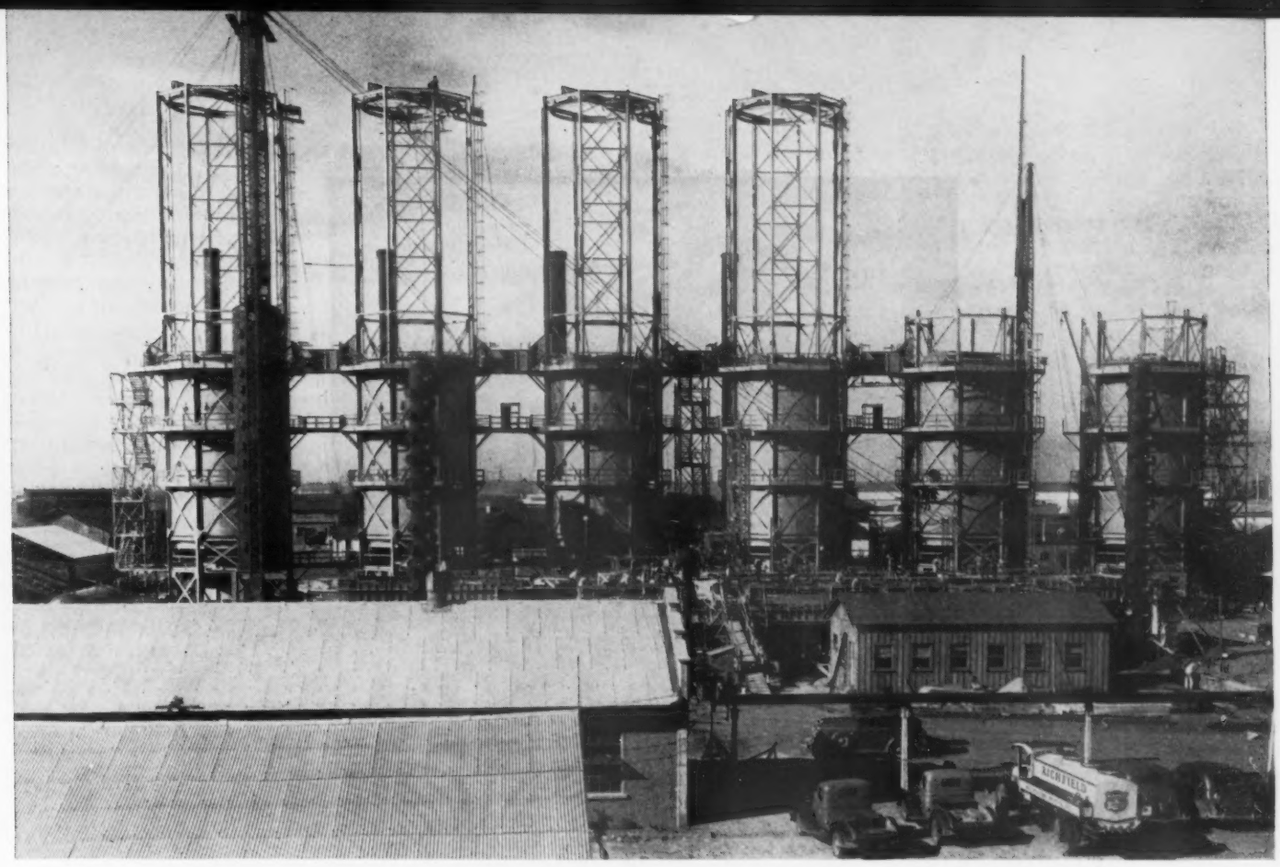
The most satisfactory process for reducing losses is polymerization of plant — as well as natural — gases for the production of a high octane number motor fuel blending fluid. The polymerization capacity in this country runs far above 100,000,000 cu. ft. of gas per day, with yields varying from about 3 gallons per thousand upward. Although many refiners do not give any premium valuation to polymer gasoline in their bookkeeping, others estimate its value at from 1.5 cents to 4.5 cents a gallon above that of regular refinery production motor fuel.

Of the two types of polymerization, the Universal Oil Products catalytic process is the only commercial one of that type. Two thermal processes are in commercial operation, the Polyco thermal process and the so-called Pure Oil process. The first uses a phosphoric acid catalyst in packed or trayed towers to effect or hasten the polymerization reaction.

The thermal processes depend on more elevated temperatures and pressures. The difference in total yields is



Research is the backbone, the motive force behind every industry. Trends in oil refining, and its devotion to research are indicated by this view of the new Phillips Petroleum Co. laboratory at Bartlesville, Okla.



The spirit of the refining industry is typified by this long battery of de Florez cracking furnaces, through each of which pass daily several thousand barrels of crude and fractions of crude petroleum to be decomposed into motor fuel to supply the more than 29,000,000 motor vehicles of this country. This is a view of the battery of cracker furnaces in Richfield's plant at Watson, Calif.

in favor of thermal polymerization, using mixed paraffin and olefin gases where no cracking of the saturates is used to produce olefins. Catalytic operation on the other hand has the advantage of lower installation costs and lowered costs for operation, excluding the cost of the catalyst, the efficiency and life of which has been increased remarkably during the last three or four years.

Prior to recent months polymerization has been considered generally a process applicable economically only to larger refineries with great quantities of cracked and saturated gases. It has been demonstrated this year, however, that the small catalytic polymerization unit, operating on less than a half-million cubic feet of butenes and propenes per day, can be made to pay its way very satisfactorily, according to operating records to date. (See Refining Technology Edition, NAT. PET. NEWS, Aug. 10, 1938, page R-371). This development opens polymerization to a number of refiners estimated at 135 plants in this country, with a conservatively estimated crude capacity in excess of 1,250,000 barrels per day.

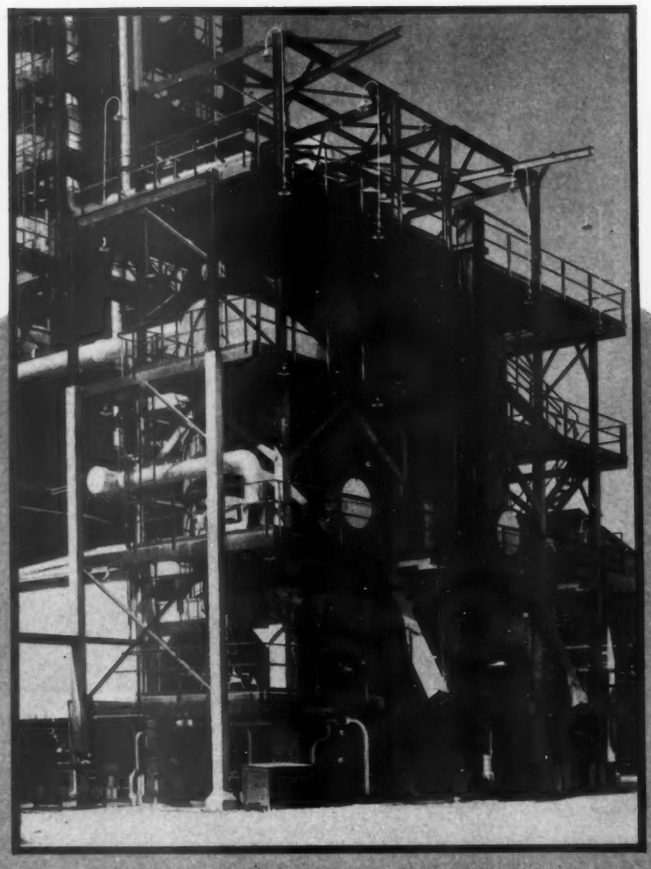
THE increase in total gasoline yield of 4.8% practicable with polymerization may easily make the difference between profit and loss for the small as well as the large refiner; very probably the advantage may be greater for small than for large-scale operations. With even a two-cent per gallon premium on polymer gasoline, the added return to the small refiner in crude and lead fluid saving will cover a considerable capital outlay and increase in overall operating costs, in addition to enabling him to compete in octane rating in the absence of a lead license, without the use of benzol or other high octane number blending material. One small refiner in Michigan estimates that his small $10,000 unit was paid out in 37 days or less; in at least one case a value of 10 cents per gallon is placed on the polymer product, as a fair evaluation of the material in that refiner's economy.

With a 4% increase in gasoline yield, (average 2% on the crude), polymerization will add 0.84 gallons of motor fuel per barrel of crude processed. Assuming a price of 7.5 cents for the polymer, and deducting 1.7 cents as the fuel equivalent of the gas—if salable as fuel—the net value of the polymer gasoline is 4.6 cents increase for each barrel of crude processed. With a 50,000-barrel throughput in this hypothetical refinery, the polymerization plant will add $2300 per day gross profit. From this sum a considerable amount may be subtracted to pay for installation and operating and still leave an overall profit to the refiner. Even if the polymer is valued at the same price as regular grade refinery gasoline, (say 5.5 cents per gallon), the gross profit margin is $1450 per day for the polymerization operation.

THERMAL polymerization methods have been adapted to relatively small scale operations in a few instances, though not to such small plants as those mentioned above for the catalytic units. The Pure process, it is understood, has produced 6-8% increase in gasoline yield on operations involving a large gas loss in vapor phase cracking where less than 6000 barrels or so of charge stock was run. It will require further operation in small capacities to determine the lower limit of economy in this type of unit.

It is extremely difficult to obtain dependable figures which may be generalized safely to show the reduction in operating and installation costs of the modern so-called topping-cracking unit in comparison to the types of separate units generally built and operating six or seven years ago. Normally a cracking unit is worn out and obsolescent in that length of time. Methods of operation and operating conditions, charging stock properties, the individual refiner's special situation, all vary too widely to settle on a definite, representative figure.

Comparative estimates, assuming a set of operating conditions too voluminous to enumerate here, indicate that separate operations going to ultimate yields of gasoline, tar and gas and which include the operations of distillation, viscosity breaking, gas oil cracking and naphtha reforming, treating and rerunning will cost approximately 26 cents per barrel of crude run, or slightly less. The corresponding operation of a combination type unit, including stabilizer operation will cost slightly less than 20 cents per barrel of crude. Eliminating viscosity-breaking will further reduce



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this cost by about 2.5 cents per barrel of crude, with probably a reduction in gasoline yield. The modern type of operation shows a 6.5 cents per barrel, or 25% reduction in operating cost compared to the old method. This equals ¼ cent per gallon of gasoline, assuming a 65% total yield. Such a reduction can and usually does mean the difference between prohibitive loss and measurable to comfortable profit to the refiner.

It is sufficient to know that appreciable savings can be effected by replacing obsolescent equipment of six years ago with new cracking units operating on the greatly improved methods which have resulted from the long strides made in process development over this period of low prices and high experimental development. The savings are effected in increased yields, higher standards of properties which control market values, lowered costs and decreased losses.

In addition to the processes mentioned, the number of other new or recent processes available to the refiner in many cases make his choice of a given process more of a headache than is the matter of decision as to whether or not any new process shall be adopted at all. Research, and commercial developments therefrom, invariably thrive better during recession periods than when prices and consumption are high enough to make almost any sort of processing pay. Within recent months we know of whole engineering and processing staffs which have spent weeks laboriously assembling and studying data to determine not only if some general type of process is to be adopted but also which one of two or more offers the greatest advantages in that company's specific setup.

In the cracking field a development now disturbing the minds of most refiners is the Houdry process, referred to as a catalytic system, which can produce high octane number gasoline in large yields from gas and fuel oils at low cost. Much of the perturbation among refiners about this process is doubtless due to the lack of specific information available on it, and the awesome figures on yields, properties, etc., which have been bandied about in verbal discussion of it. It is understood that Socony-Vacuum Oil Co. and its subsidiaries and Sun Oil Co., generally considered the co-developers of this process in America, are each building several units to use the process. Estimates of a total of from 12 to 20 units are heard as horse-back figures, without, however, any corroboration from the companies doing the building.

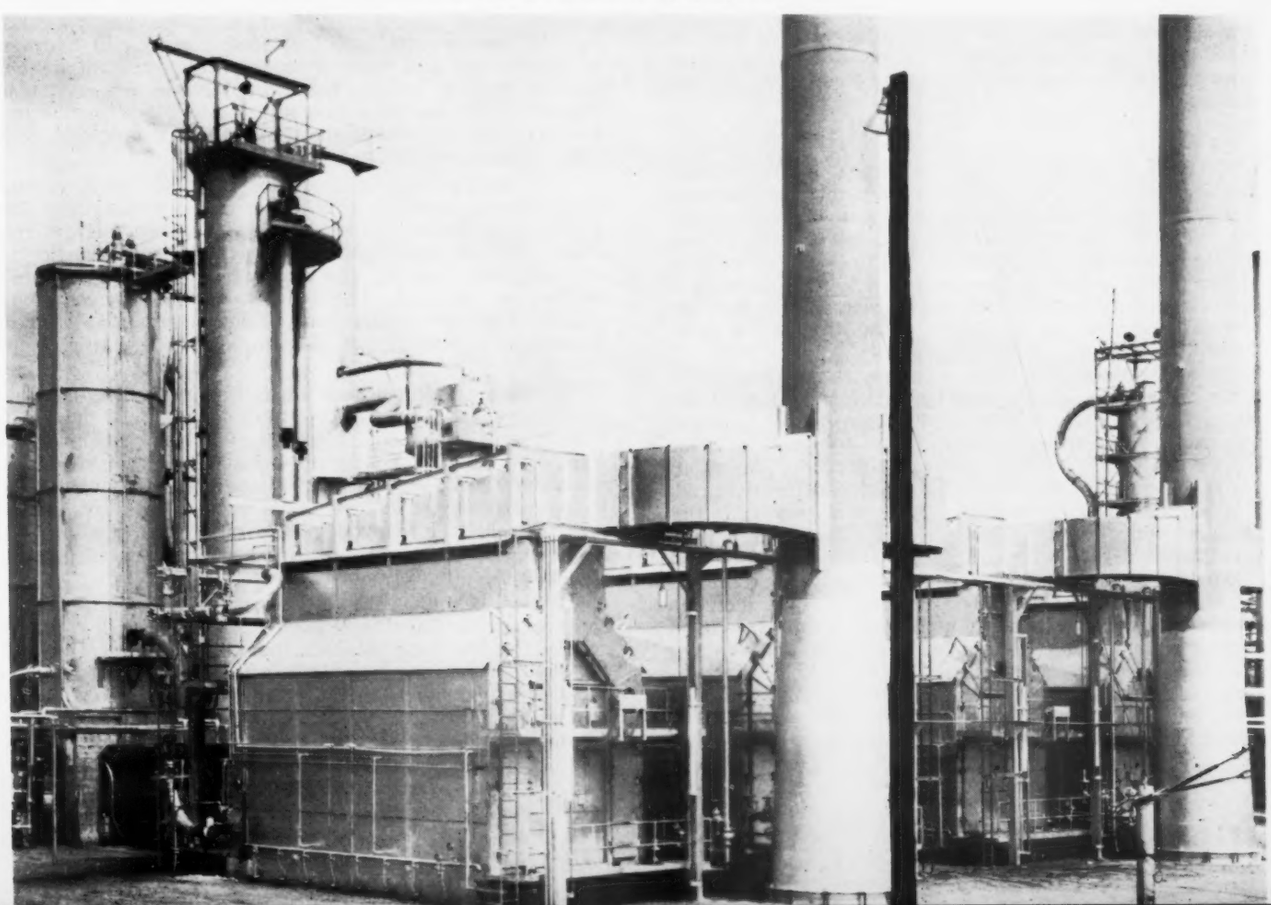
Adoption of a process operating at low temperatures and pressures, with a cheap and rugged catalyst and producing gasoline of very high octane number in high yields may well give the users of such a process an economic advantage which cannot be laughed off easily. Whatever the facts of the case, accredited facts on the Houdry process being conspicuous by their absence, the process is nonetheless one of the most-talked-of among refining methods at present. Another year should see more exact data and results of the use of the Houdry principle in cracking. A margin of a few octane numbers in blending value looms huge on the refiner's horizon today.

ANOTHER new-old process is the so-called T.V.P. process. Originating as the so-called Knox process in a small plant at Texas City, a few units were built, notably those by Shell at Wood River. Some time ago the Alcorn interests took over its further development, established an experimental unit in New Jersey, built, or rather rebuilt a unit at the Old Dutch plant at Muskegon, Mich., and built also a new unit at Bradford Oil Refining Co. for reforming Pennsylvania gasoline and cracking kerosine and gas oil there.

Details of the system have been radically changed from the earlier plants and the process appears to show interesting possibilities and practicabilities. It has been rumored that another installation of this process is planned for the Rocky Mountain area, in a new refinery built to refine some of the crude there which has been "thrown back" on its producers because of the increasing supply of Turner Valley, Can., crude, which eliminates the necessity for small Canadian refiners to use imported Montana and Wyoming crudes.

High pressure-temperature hydrogenation has been rather dormant for some years, chiefly because of the high operating and installation costs. The so-called "wet method" of hydrogenating polymerized olefins to produce 100 octane number fuels for aviation purposes has shown efficient results and is now used in nearly a dozen units throughout the country. The I. G.-Standard process has been used chiefly for the production of solvents, special lubricants and synthetics in the fuel, solvent and lubrication fields. Rumors

The new UOP equiflux type of furnace is being used in an increasingly large number of 1938 cracking units. Its high efficiency, obtained by heating all sides of the coil tubes is another instance of the application of modern engineering science to practical industrial problems. This view is from Cosden's new cracker at Big Spring, Texas.



Trimness and efficiency are watchwords in natural gasoline plants, such as this new Texas Co. plant in the Rio Bravo field, Calif.

of the building of a new experimental plant for research on methane and ethane gases by high pressure hydrogenation are persistent, but as yet no authoritative announcements have been made.

The "Forward" process of cracking has been given impetus by the reported construction of a large experimental unit in Louisiana, in which it is presumed further research will be carried on by Doherty Research Corp. in developing this process. Producing a high octane number product, high in aromatic hydrocarbons, this process appears to offer possibilities for the production of benzol and its homologues for chemical synthesis as well as for special fuels.

Little specific mention can be made here on developments by the two most important research organizations, Universal Oil Products Co. and Gasoline Products Co., mainly because the improvements in the processes developed by them are continuous, come along gradually and slowly with infrequent outstanding new or startling "discoveries". Their two types of processes still dominate the cracking technical field and their licensees produce the huge mass of the nation's cracked gasoline. The latter company this year increased its research budget, while the position of the former in research is also too internationally known to warrant comment.

ANOTHER most interesting development is the recovery of natural gasoline, and simultaneously the concentration of propane and butanes from the tail gases, by self-refrigeration. A plant operating on this principle has been built and is in operation in South Texas, and first reports indicate that this principle may go far toward solving the problem of polymerization and other processes by reducing the cost and increasing the recovery of charge stock suitable for those purposes.

Following along with these processes already adapted to commercial refining needs may be mentioned some of the newer research developments which in most cases have not been adopted commercially as yet. Alkylation, briefly, is the process of adding a paraffin (saturated hydrocarbon) to an olefin (possessing a double bond), to form a saturated product of higher molecular weight. By such a combination of iso-butane with butenes, Dunstan and his colleagues of Anglo-Iranian Oil Co.'s research department have produced 90-100 octane number motor fuels at relatively low temperatures and pressures, therefore presumably cheaper than the methods now used commercially to make olefin-type fuels of similar octane rating. The latter have some disadvantage in that they are still unsaturated. This same line of investigation has been followed by a number of laboratories in this country and is being pushed more intensively recently.

Mention may be made of isomerization methods, by which paraffinic straight-chain hydrocarbons may be converted to the iso- type of molecule, increasing the octane rating of the hydrocarbon. These methods, so far as has been disclosed, are still in the small scale stage, although much is being carried out in these research fields which are not discussed at all with outsiders. However, the possibilities are enormous, in the event low-cost operations can be perfected.

THE quality of automotive and locomotive diesel fuels is assuming greater importance with the increase in the number of these units in use. In 1937 a total of 227 diesel- electric locomotives were in use in the U. S. No figures are available on the number of automotive diesels in use but the number is constantly increasing. Much of this fuel, as well as lubricant, business will go to the refiner who can supply the best fuel at an economic price. Two methods are available for improving the cetane rating—ignition quality—of existing fuels, solvent extraction to remove the low cetane number constituents, and hydrogenation to add hydrogen to unsaturates and make a more paraffinic, straight-chain type of fuel. At present general opinion is that solvent extraction is the less expensive and this process may be used where the overall cost of the finished fuel makes such treatment economically sound.

No great strides in improvement of solvent extraction have come to light for lubricating oils recently. The Sun-Alco process for dewaxing with propane, using self-refrigeration, uses the same general principle adopted earlier for dewaxing-deasphalting, the units of which are in use in a number of refineries. The Sun-Alco system uses continuous chilling and continuous deasphalting, deresining and dewaxing in one operation, as compared with earlier batch systems.

Filtration methods and media have advanced considerably in the last two years and the refiner now is faced with the dilemma of choosing between several processes and proprietary products. Among these may be mentioned Porocel, understood to be an aluminum oxide material developed by L. Sonneborn Sons Co. and taken over recently by Attapulgus, which has already displaced older filter materials in Pennsylvania and elsewhere for clarification and decolorization of lubricating oil stocks especially.

Filtrol, developed by the company of that name, is a synthetic or semi-synthetic material, highly efficient for decolorizing dark heavy oil stocks but some refiners consider it too expensive. X-yte is the trade name for a processed bauxite product, standardized as to physical condition and decolorizing efficiency, developed by Max B. Miller & Co. from Arkansas bauxite deposits. This product has only recently

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made its appearance in refining operations, but it is reported to have some advantages in various types of filtering operations. Florite, is another product offered comparatively recently for filtration purposes, brought out by the Floridin Co.

In chemical and physical treating operations the number of processes made commercial within the last two or three years may be confusing to the refiner who is choosing a process to meet a new condition or improve an old one. Nevertheless he has several new methods at his call, the good and bad points of which have been proved with some conclusiveness by more or less extensive experience under a variety of refining conditions.

The combination of the Stratford Development Co.'s acid-centrifuge treatment for high-sulfur cracked distillate with the Standard of California's (Halloran) low temperature treatment of light products, the combination being called the Stratcold Process, has been installed in two or more refineries. This followed a period, after the first large acid-centrifuge unit was built by Continental Oil several years ago in Baltimore, during which practically no development work was carried out on the process. This process is reputed to produce excellent results in high sulfur distillates. Reports say that probably seven or eight units totalling 80,000-90,000 barrels, are under serious consideration now.

The Perco process, developed by Phillips' research department, and using copper chloride in two methods, the "dry" and the "wet," has been installed in 78 refineries to date, and is credited with good results both on straight-run and cracked distillates in converting mercaptan sulfur to innocuous sulfur compounds, improving lead susceptibility and corrosion characteristics. This process is also open to general license by the industry.

The U.O.P. copper treating process by Universal's research staff, using copper sulfate as the treating agent, has been applied in several refineries on especially cracked and polymer gasoline with reported excellent effect on the product. The lead sulfide (PbS) method was just recently perfected to the stage where it may be offered for license by refiners. It employs sodium sulfide converted by the reaction to lead sulfide for the conversion of mercaptan sulfur in light distillates to other sulfides less embarrassing to the fuel refiner. Standard Oil Co. of California is reported to be using this process, and some 50,000 barrels of capacity, in four or five units, is under careful consideration at present, though licenses are not yet signed.

In addition to these licensed processes, improved technique in the use of doctor solutions and caustic soda washes for preliminary treating of sulfur- and gum-containing distillates have simplified the refiner's problems and have succeeded in reducing costs and losses, as well as retaining and improving lead susceptibility and octane number.

Study of the whole refining situation brings us to the unavoidable conclusion that the refiner is becoming more a producer of specialized products, that the processes for making them have long since emerged from the rule-of-thumb cocoon and are based on the best chemical and engineering knowledge. The refiner's greatest problem is to fit the product specifically to the consumers' demands and the work the product is to perform. Therefore the standards of his product are determined in the light of the requirements met by his sales department.

Competition by even one outstanding company in the field will eventually force all or most refiners to meet new product quality standards. To meet those standards, which are always increasing, new processes, new equipment and new methods are imperative. Consequently the refiner is always on the lookout for processes and equipment which reduce costs, increase yields and improve the qualities most in demand in his products.

Periods of business recession when operating margins go lower and lower are the times when the refiner studies most intensively the advisability of adopting new processes. Although adoption of new processes may be delayed by the lack of funds for capital investments, at the earliest opportunity new methods will be installed, forcing still other refiners to follow suit. The result is a fairly complete revamping of refining practice in most phases about every five years.

During recession periods labor costs are lower than in more prosperous times. Recently steel costs, the largest single item in refinery building after labor and engineering, were considerably reduced. Plate equipment was reduced in price 8-9%; piping of various kinds was reduced 4% to 7.5%, depending on its kind and the location of steel mill and installation point. As a result, the cost of the equipment for the refinery at present is appreciably reduced, giving an added impetus to the tendency to build new or revamp old units. The overall reduction in unit costs by this reduction is estimated by qualified engineers to be as high as 5-6%, varying widely of course in individual instances. For these reasons particularly construction costs are lower now than 15 months ago.

Fall and winter are times when personnel may be spared most easily from refinery operation to work on new construction. It is simpler to shut down units for revamping, or for complete replacement during the slack season than in summer when top consumption rates necessitate continuous operation at capacities near the plant maximum. As is generally the case, construction during fall, winter and early spring may be expected to increase, other factors being of equal effect. The lowered cost of obtaining capital by borrowing, stock or bond sales by sound reputable companies is also having its effect on immediate future prospects. Recently Standard of New Jersey raised $85,000,000 on notes and debentures to finance a part of its current $175,000,000 capital investment expenditures. Standard of Ohio has sold $5,000,000 in similar fashion, at low interest rates. Atlantic Refining Co. will vote soon on a $50,000,000 bond issue and on the plan to sell $12,500,000 worth of stock. Phillips Petroleum has announced a $25,000,000 issue. Interest rates on these bonds, etc., are reported at from 2¾% to 5%.

Even such a brief summary of refining trends as is here given shows conclusively that refining trends are speeding up toward specialization of product and process. Treating methods have been so specialized that half-a-dozen different methods may be used on the same type of product, the choice by the refiner depending on the conditions of his own problem, the advantages shown by one process over another under those conditions, and the excellence of the salesmanship.

It has been said that adverse times must come to any business organization at intervals, in order to force the removal of "dead wood" from the organization and return its operations to a more profitable, business-like basis. This is essentially true of refining processing and equipment; Narrow, disappearing margins force operators to study, rebuild and change methods to stay in the picture. Changing requirements in products force the same activities with even more certainty. Introduction of a new process for making an old product better and cheaper forces competition to engage in research and the adoption of new ways to meet the inroads of the new competitor.

Never in history has the refiner had so many processes, so much new equipment from which to choose, to better his manufacturing methods to meet changing economic, technical and market conditions. Never has the problem of choosing been a more difficult one, the number of things from which to choose alone sadly complicating the problem. And never has the need for maximum efficiency in refining been so great. Trends indisputably show that this condition of increasing competition will continue with a rising rather than a falling curve, and that what is remarkable in refining practice now will be obsolescence and industrial senility in the 1940s.

Refrigeration for Recovery of Natural Gasoline, Polymerizer Stock

In the Sept. 21st issue of Refining Technology will be published for the first time an article on "Recovery of Natural Gasoline By Refrigeration," by D. W. Wilson of New York, M. W. Kellogg Co.

This new process offers to become important both in natural gasoline manufacture and for recovery of propane and butane for polymerization, for "bottled gas" or for other purposes and the details will be of extreme interest to every technical man in the industry. Simplicity of design reduces plant installation cost remarkably.

Read the story of design and results of this process in the Sept. 21st issue.

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Process Advances Motive Force Of Refining Industry

SOMEONE has said that the refining industry is plagued by a hundred processes. Imagine what the plague would be, with present product quality demands, if we did *not* have these processes with which to produce those qualities! An industry which does not make its job both harder and easier by progress in methods is as dead as Egyptian mumification and passes out of the picture as completely as has that ancient and lost art.

Choice of processes to refine a given series of products is the one over-shadowing factor within the complete control of the individual company, a factor which may determine the difference between a healthy, progressing company and one which is dying on its feet. Crude prices at present are fixed by such agencies that the refiner has at best a minority influence in their fixing. Market prices for his refined products are more at the whim of competition than under the control of either seller or buyer.

Much of recent process advancement has been devoted to three major lines of research; increasing yields of major higher-demand products, particularly motor fuels; improving major properties, such as ignition quality in fuels, oxidation stability, carbon deposition and film carrying ability in lubricants; and treating methods which retain or enhance these most needed qualities found in the raw or unfinished product. Reduction of manufacturing costs is a prime prerequisite with all these considerations.

The most far-reaching advances in technology are crowded around cracking and its corollary processes—polymerization, hydrogenation, cracked distillate processing. Methods for improving lubricants have advanced farther than has cracking, considering the state of lubricant technology five or six years ago. Yet, since lubricants compose so small a percentage of the yields from crude, and the money value of the total production is so small compared to motor fuels and some other products, the relative importance of lubricant process improvements to most companies is far less than those processes dealing with fuel manufacture.

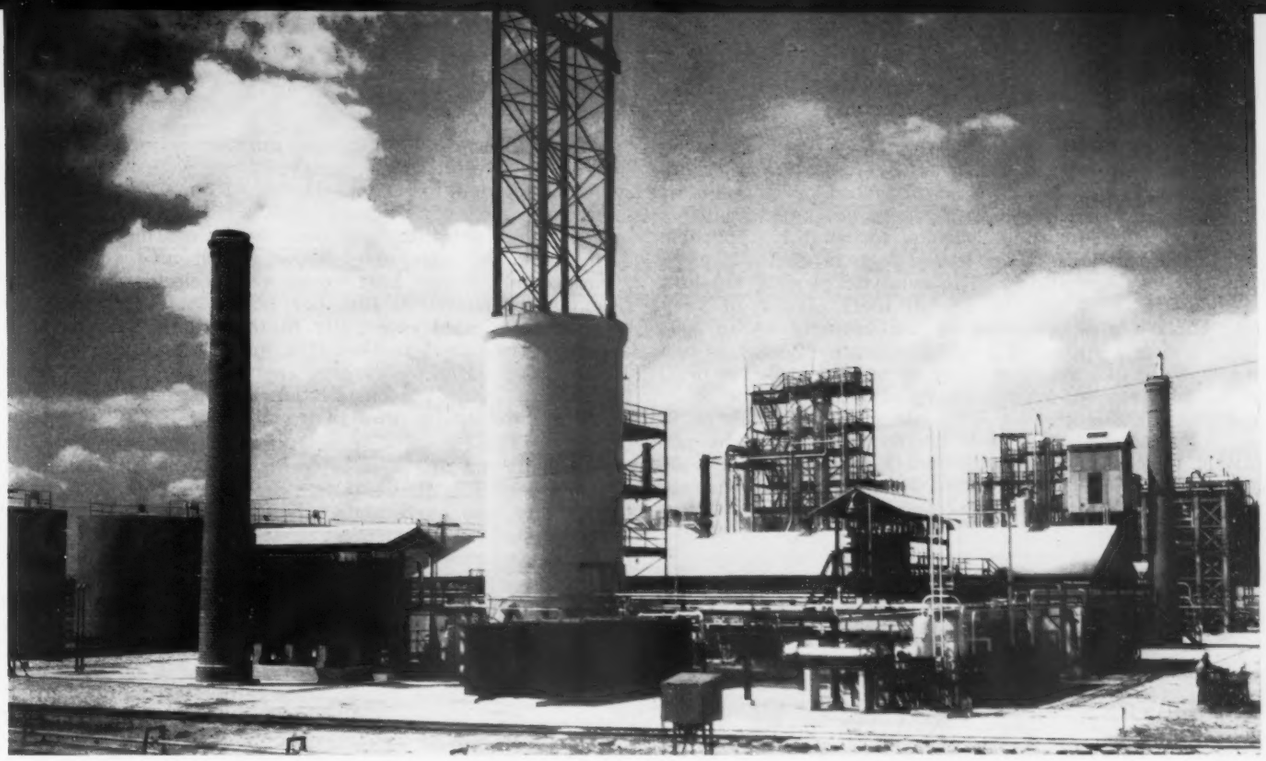
Without belittling at all the far-reaching scope of the composite advances made, the principal cracking processes have brought forward little of a startling nature in innovations during the last year or two. Rather have these processes—the Universal Oil Products and Gasoline Products groups of processes—been studied intensively and without letup to perfect those innumerable refinements of operation, and of equipment by which any process system reaches or approaches nearer to its peak of performance, yet none of which individually are extremely important. These processes today have the greatest field for intensive, practical, world-wide research, on a large-plant scale, under the most competitive commercial conditions known to the industry. Between them, they are in immediate contact with all details of most of present day cracking. The robustness of the campaigns for the utilization of these facilities for practical research is one of the greatest promises for healthy, aggressive cracking progress in the industry.

Emphasis must be placed on the double problem of the refiner, that of increasing gasoline yields and at the same time decreasing his heavy fuel oil production. One of the methods for accomplishing this—not a new one but yet not used as widely as it should be—is that of running to coke instead of making heavy liquid fuel residua. First-hand authoritative estimates by the best engineers in the field show that, in cracking heavy oils, a gasoline yield, running to Bunker C fuel, of 53% of 70 octane number, 400 E.P. is average and typical. Running to coke to the same gasoline specifications, a yield of 68% is obtainable without difficulty. Coke may or may not be a problem in its disposal; those companies which have marketed it locally report little difficulty in disposing of the quantity which they produce. Others state that it may be burned as plant fuel or even discarded as waste with a profit on the whole operation.

Engineers believe a good opportunity exists now for development of a process for the economical, profitable coking of fuel oil outside the cracking unit as well. The Knowles oven did a good job but left much to be desired, and that or some other process should be brought up to date, they say, and perfected to aid in solving this fuel oil problem, especially in the matter of mechanical quality of the coke produced, and in coking yields and cracking charge stock produced. Gases suitable for polymerization and for synthetic chemicals may also be produced in this type of processing.

IT is in the fields of other cracking developments where more obvious progress has been made known, in many of which the relative lack of plant operations under widely varying conditions has not yet determined the limits of application of these newer processes. The T. V. P. (True Vapor Phase) process has come to the fore with two installations, one at Muskegon, Mich., and one at Bradford, Penna. This process originally vaporized the charge stock and introduced it into huge "stoves" filled with checker-brick, into which also highly heated gases were admitted, the heat of these gases effecting the cracking in the vapor phase. Shell Petroleum Corp. at Wood River is reported to have operated such a plant profitably in the past under a given set of conditions involving a surplus of heavy fuel oil. This unit is not now operating, we understand, being supplanted by Dubbs units of last-minute design.

Present design of this process, under the efforts of Alcorn Combustion Co., includes a double-coil tube still, in one coil of which the charge stock is introduced and heated, and in the other tail gases from the vapor recovery unit are heated to temperatures up to 1000° F. or higher, cycle gas and charge vapors being mixed beyond he coils to produce the degree of cracking required in the charge stock vapors. Pressures are nominal, up to 125 pounds gage being typical, and may be varied to suit the charge stock or the product qualities desired. No data are available to show whether or not appreciable percentages of the heating cycle gases may be polymerized or condensed with the cracked vapors in this operation. The



Hydrogenation oven stall of reinforced concrete housing the hydrogenation chamber 40 feet long and weighing 50 tons which operates at 3500 pounds pressure

opinion of some technologists is that this is a likely reaction to expect; others doubt it because of the low pressures used.

The Houdry catalytic process is doubtless the one which has been most talked of during the last year in refining technical circles. Claims of 90-100 octane number blending value for the Houdry product are circulated among technologists with yields in the 70%-90% range, none of which claims have been substantiated from any authentic source. The finished product is said to have an octane number of 80-85, and plant operating conditions are reported mild in terms of conventional thermal cracking conditions.

Earlier data on the Houdry process (Nat. Pet. News, Dec. 27, 1933, p. 27) showed it to be a vapor phase, catalytic process, using a catalyst of activated silicate of alumina, for example, plus a metal oxide such as nickel. The charge stock as then outlined must be vaporizable. The residuum was described as having the properties of gas oil which could be cracked by thermal methods, such a combination system yielding 73% of 72-73 ASTM octane number gasoline and 9% of heavy fuel oil. Polymerization of gases would add 2-5% to the total yield, technologists claimed.

OF its present operating details nothing has been made public, although it is supposed that the present process, developed far beyond the 1933 stage presumably, still follows the general outline referred to in the article of that time. Twelve to 16 units are reported to be constructed, under construction or definitely planned for the next year.

Among the cracking processes which may still be considered in the large-scale experimental stage is the modern version of the Forward process. Originally this system used highly superheated steam as the heating medium, the steam, at temperatures at which it may be dissociated into oxygen and hydrogen, being mixed intimately with the oil in liquid or vapor phase to obtain cracking temperature and reaction. Steam temperatures of 1200° F. are reported; operating without dephlegmation or fractionation, a synthetic crude was produced with 1050-75° F. coil and reaction chamber temperatures, at 225 pounds pressure, which yielded about 52% of gasoline, 6% of benzine bottoms, and 48% of bottoms and gas loss, the bottoms being 1.2 specific gravity. (Nat. Pet. News, July 8, 1936, p. 35).

This gasoline fraction is composed chiefly of substituted benzenes, ranging from benzene, C_6H_6, to i- and n-amyl benzene, diethyl benzene, methyl-propyl benzene, with traces of naphthalene. Most of these hydrocarbons have been identified, using oxidation with potassium permanganate to produce the corresponding acids, by nitration or other methods.

A large-scale unit operating this process is active at present, it is understood. The substituted benzenes are said to have the advantages of high anti-knock, without some of the disadvantages of benzol as used in blended fuels. One main purpose of this process might be to produce aromatic hydrocarbons for synthetic purposes in the chemical field.

THE combination topping-cracking unit, closely interconnected as one unit and operating on a carefully balanced system between the different steps is not new, but yet remains to be applied to a large percentage of the distillation-cracking capacity of the country. The system tops crude, usually by heat exchange and fractionating tower flashing, separates it into two or more main fractions heavier than light naphtha, "breaks" the viscosity of the heavy residuum to obtain a very heavy low percentage yield of fuel oil and a distillate stream suitable for the cracking coil, cracks the gas oil and/or heavy naphtha and kerosine fractions, may reform the whole gasoline fraction, recovers light vapors, all in one combined operation. The keynote of this system is balance carefully maintained between temperatures, pressures and throughputs of the different steps and it offers some cost advantages as well as other advantages in yields and product qualities.

The best estimates obtainable from competent engineering sources show that, operating on typical Mid-Continent crude, the older separate operation method operates at a processing cost of about 26-27 cents a barrel of crude, including vapor recovery, stabilization and sweetening. The combination method under the same conditions of charge capacity, product quality and yields, will cost slightly less than 20 cents per barrel, including viscosity breaking. Elimination of this viscosity-breaking step will reduce the cost by 2-2.5 cents per barrel. The advantage of this type of operation, where conditions are such that it can be applied, is so great that the average refiner cannot with safety overlook the possibilities indefinitely.

Polymerization is the greatest single step forward which has been made to reduce directly the plant losses

incident to distillation and cracking. Still doubtless in its infancy and capable of far greater application and efficiency than has so far been accomplished, it is the most significant technical development since cracking became a widespread success. In its various forms it is applicable both to saturated gases and those high in olefins derived from cracking operations. The catalytic process employs a phosphoric acid catalyst on an inert carrier of very great surface area, operates at temperatures up to 300° F. or more and up to 400 pounds pressure. So far as has been claimed, the reaction involves only the olefins present, a conversion of 90% or more of those present being obtained. In combination with gas cracking, such as is used by Shamrock in the Texas Panhandle, weight per cent yields of 60-70% of the C_3 and C_4 charge stock are obtained, which compares approximately with results so far obtained in thermal cracking and polymerization of refinery and natural gases.

THERMAL polymerization, of which two main processes are operating, the Pure Oil and the Polyco processes, depends on heat and pressure to accomplish both unsaturation of paraffins and polymerization of the resulting olefins. The Pure process may operate under a variety of conditions, three especially having been mentioned in the literature (Nat. Pet. News, Nov. 4, 1936, p. 47). These are low temperature-high pressure, high temperature-high pressure and high-temperature-low pressure. By this process aromatics as well as saturated and unsaturated isoparaffins and olefins may be produced, the octane number of the motor fuel increasing with the increase in reaction temperatures. Aromatics are produced in greatest quantity with the high temperature-low pressure procedures, the lower pressures with suitable reaction times and quenching promoting the formation of the more complicated, less stable benzene ring compounds. Polymerizing at 60-225 pounds and 1050-1200° F., on two dissimilar charge stocks, 1¼ to 2 gallons of reaction products were obtained per 1000 cu. ft. of charge gas, with 54.4-56.0 API gravity and 400-410° F. endpoints, the heavy gravity showing the presence of large percentages of aromatics. Using different conditions, products ranging from 30 to 60 API gravity and low to high volatility are made, it is reported, with octane blending values of from 90 to 120.

The Polyco process is applied both to refinery and saturated natural gases and to mixtures of the two. Operating at temperatures up to 1030° F. and 1800-2200 pounds pressure in different parts of the system, it has produced 1850 barrels of 76-78 octane number polymer practically free of sulfur—H_2S removed by Koppers Phenolate method prior to polymerization—from 22,000,000 cu. ft. of mixed refinery C_3 and C_4 gases. Recycle rates are high, 10% polymerization per pass being considered optimum in the plant referred to above. High tube velocities are used, and efficient heat exchangers recirculate heat to the extent of 58,000,000 Btu. per hour. Self-refrigeration by propane is used repeatedly in the system to recover unpolymerized feed stock. This unit saves up to 5000 barrels of crude per day and, though costing more than a million dollars, this installation is expected to pay out in 18 months under present conditions.

The brightest spot in the polymerization situation, especially for the smaller refiners is the adaptation and proving of the UOP catalytic process for very small units. Recently two such units, operating on a quarter-million cu. ft. or less of refinery gases, have proved their efficiency and practicability for such installations, the plant's engineers state. Operating on Michigan crude, these plants, one of which is cracking heavy oil and the other reforming heavy naphtha, operate the polymerizing units at up to 400 pounds pressure (Nat. Pet. News, Aug. 10, 1938, p. R-371) and at 300 to 400° F. heater outlet temperature, with around 75° F. temperature rise because of the exothermic reaction in the catalyst towers. Total gasoline yield from the cracking-reforming operations is increased by as much as 8-9%, and the high octane number blending rating of the polymer makes it valuable when refining low octane number Michigan or other gasolines. Conversion of the olefins present is reported as 90-100% complete during the catalyst life.

THE adaptability of this type of ultra-small catalytic unit to all situations in the small refinery may require a larger number of installations to prove the limits of sizes and conditions under which it will pay, yet it now seems fairly certain that the success of these small units shows a much wider range of plant applications to be feasible for catalytic polymerization. Paying out in from six weeks to six months, producing a blending naphtha valued as high as 10-11 cents per gallon is the refiner's economy, and reducing crude demands by several per cent for a given gasoline output, these units seem to have a ready-made market. It is estimated about 135 refineries, with 1,250,000 barrels daily crude capacity, are potential users.

Another angle of polymerization is introduced by the combination of butane-propane either or both, with gas oil or similar charge stock, or with heavy naphtha or kerosine for reforming or cracking. Heated in the same coil, or in separate coils and the two streams commingled in a flash or reaction chamber, this system has been utilized it is understood for some time by more than one company. Increased gasoline yields from 2% to 5% have been reported from one operation. Details of the process are not available as yet, but the possibilities of thus combining cracking and polymerization are interesting to the inquiring technologist.

Large-scale production of 95-100 octane number aviation fuels is the most important single development in the polymerization-hydrogenation field. If, for example, 93-95 octane number fuel is desired, the product from the UOP phosphoric acid polymerization, which includes polymers of i-butene, n-butene, propylene, and very probably some of the paraffins (by alkylation with the olefins) is hydrogenated by either the cold sulfuric acid or the high pressure method. This process gives a much higher yield —two or three times, usually—than the hydrogenation of a selected i-butene charge, for which the cold acid process of Standard Alcohol Co. is used for hydrogenation. For the latter the i-butene fraction from cracking still gases is concentrated to technical purity, polymerized and hydrogenated to produce the 100 octane number blending fluid which goes mainly into the new aviation superfuels.

It is generally conceded that the possibilities of polymerization operating especially on saturated natural gases have only been touched. The great bugbear, of course, is costs, both installation and operating-maintenance costs,

A 28,000 barrel-per-day atmospheric-vacuum crude distillation unit, typical of the colossal size of modern distillation equipment which has helped to keep gasoline the lowest priced product on the market. Courtesy Gulf Oil Corp.

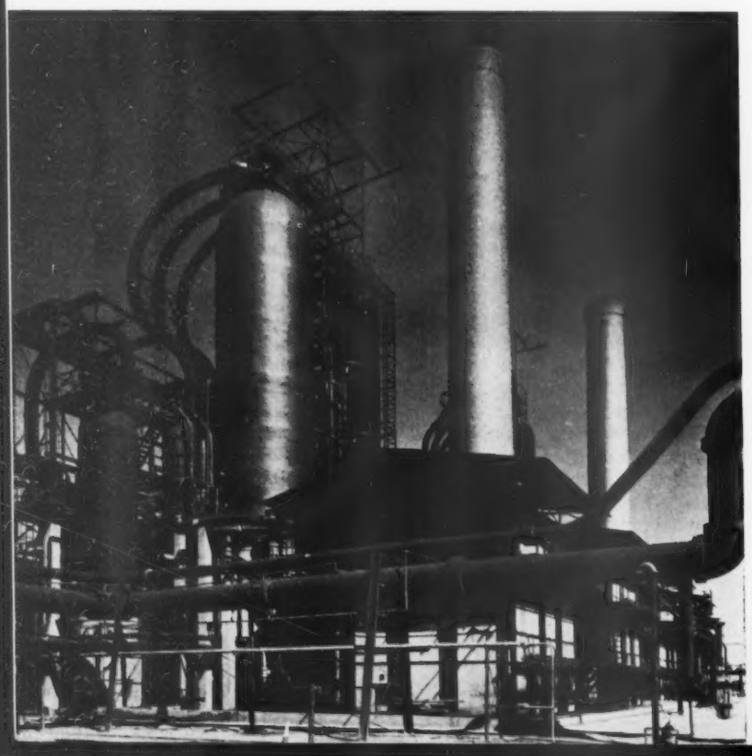


Photo News valve values

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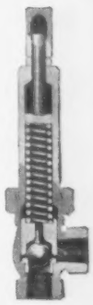
MAXIMUM DOLLAR VALUE IS A MUST FACTOR in Edward valve design. Edward cast and forged steel valves, each part built to do its job right, help keep petroleum industry expenses down. Material—the right steels, processed right—is the one chief element. Edward laboratories, equipped with finest precision appliances, made by the leading builders of scientific instruments at home and abroad, control all steps from research, specification, acceptance, and process, to the finished valve. Improvement in procedure is continuous. Know the Edward line. It includes all standard sizes and pressures.

USE THESE GAGE VALVES freely on instrument lines, sampling connections, and in many places in refineries and oil fields where high pressures call for small, sturdy and reliable shutoff valves. Fig. 152, needle type, and Fig. 150, swivel plug disk with straight-through flow. Forged bodies in carbon and alloy steels for quick delivery from stock.

TO PROTECT heat exchangers or other pressure vessels from excessive stress, Edward Fig. 141 (right) is a forged steel relief valve in sizes up to 2 in., screwed ends, globe and angle types. Stainless steel balls used instead of disks — do not stick and do reseat tightly. Fig. 158 (below right) is a globe stop valve for lines on indeterminate but possibly very high pressures. Stainless steel parts resist abrasives. Needle swivel disks for accuracy of regulation, malleable handwheels.



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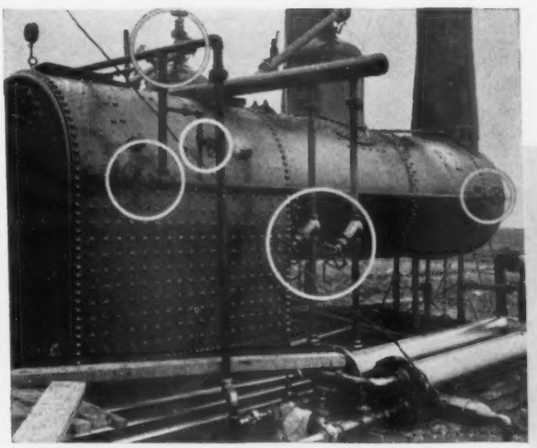

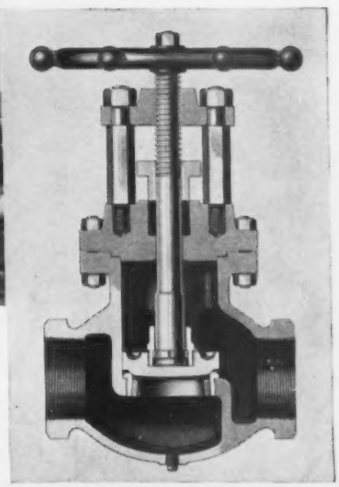

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MAKING STEAM in the oil fields means high pressures now. Necessity for quick delivery of the right valves has brought sharp movement to Edward. For feedline valves, blow-offs, forged steel valves for drip, drain and miscellaneous jobs, buy Edward oil field valves. For steam mains use Edward cast steel non-return valves or globe or angle stop valves (Fig. 6528 right).

EDWARD VALVES

Stop · Check · Blow-off · Non-return · Feed Line · Relief · Bleeder Line · etc.

especially with high pressure-high temperature thermal methods, where heating and pumping are both expensive, where equipment must be heavy and service life of much of the equipment is necessarily short. As technology, engineering and metallurgy progress, these costs will be reduced and units may be operated more economically and in smaller capacities. The ultimate for both cracking and polymerization may be the prohpecy of a well-known fuel technologist of a few years ago—the breaking down of petroleum into its simplest components, and the recombination of those components into the types of hydrocarbons possessing the qualities needed in the finished product. In great measure that operation has already been realized.

CONSERVATION—that over-spoken and under-used principle—will be served better by polymerization and its colleagues, hydrogenation, isomerization, alkylation and analogous methods than by any other set of scientific principles yet known to technologists. Isomerization is the process whereby paraffinic hydrocarbons are changed in structure to isomeric compounds of higher octane number, represented by changing, under heat, pressure and/or catalysis, a normal octane to one or more of the isomeric octanes, such as 2,2,4-trimethyl-pentane (iso-octane) and 2,2,3-trimethyl pentane with octane number slightly higher than the 2,2,4-structure which is the product used as the standard in knock rating primary reference fuels.

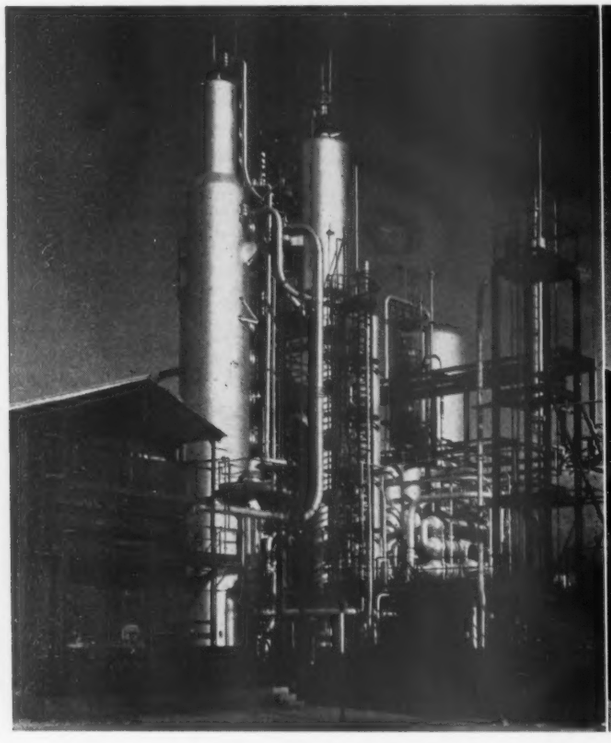
Ipatieff shows that cyclohexane can be converted into methylcyclopentane in the presence of alumina catalyst at 450° C. (842° F.), under pressure in a closed bomb. Several methods for isomerization are under application for patents, but the process has not been reduced to commercial practice so far as is known, at least for the production of motor fuels. Given the volumes of natural gasoline hydrocarbons in the butane-octane range which could be isomerized and combined with straight-chain or branched chain olefins from the same source by alkylation, it is not difficult to see the extent of the possibilities here for super-fuels. Aviation fuels especially offer a field for this type of research.

Thermal hydrogenation has one serious drawback at present, its high cost. Several years ago Standard Oil Development Co. showed that yields of 100-105% of the heavy oil charge can be produced, either as light gasoline products or as lubricating oils, by the use of temperatures above 1000° F. and pressures up to 3000-4000 pounds or higher. Costs have prevented the adoption of this process widely in spite of its excellent technical advantages.

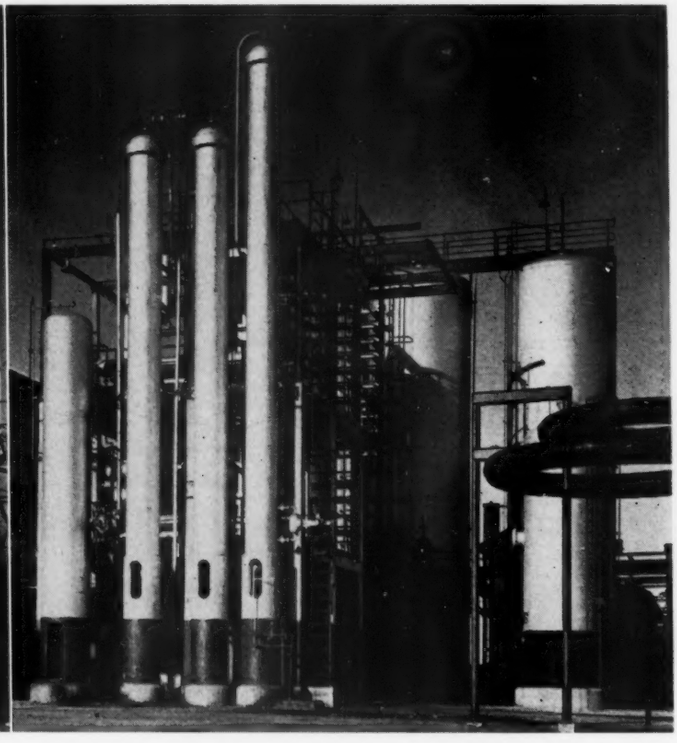
More recently the "wet" sulfuric acid method for polymerizing butenes, and the nickel catalytic method for hydrogenating the resulting di-isobutenes to iso-octane for aviation fuels of 90-100 octane number have been perfected, as well as the UOP phosphoric acid catalyst for polymerization of the same type of material. Hydrogenating the di-olefin at 180-190° C. (356-374° F.) and 15 to 60 pounds pressure, Shell Development Co. has produced ten million gallons of 98-100 octane number aviation fuel. By the isolation of higher polymers a large number of different hydrocarbons may be produced, operating conditions being varied to yield the product desired. (Nat. Pet. News, June 15, 1938, p. R-291).

INDICATIONS are that the army and navy air corps may use as much as a million barrels of 100 octane number fuel during the fiscal year 1939. The consumption by these two agencies is likely to increase as time goes on, since particularly the army is buying engines requiring this grade of fuel exclusively, except for a few training plane engines. Reported capacities for similar hydrogenation plants in this country make it certain that our capacity for meeting such fuel demands is adequate for some time to come.

Further in the offing, but with most interesting possibilities, is the much-rumored thermal or thermal-catalytic treatment of methane and ethane. Medium to large-scale operations are planned by a combination of companies, it is understood, to investigate the possibilities of this reaction, although no data are publishable regarding the direction which the research is taking. Benzene is produced from the pyrolysis of methane, 0.3 gallon having been produced by Smith, Grandone and Rall (R. I. 3143, U. S. B. of M., 1931) from 1000 cu. ft. of gas, plus 2.5 pounds of tar containing about 35% of naphthalene and anthracene, and 65% of undetermined hydrocarbons, with 710 cu. ft. of unreacted methane and 440 cu. ft. of hydrogen in the tail gases. One of the commercial methods for producing hydrogen for hydrogenation use is by heating

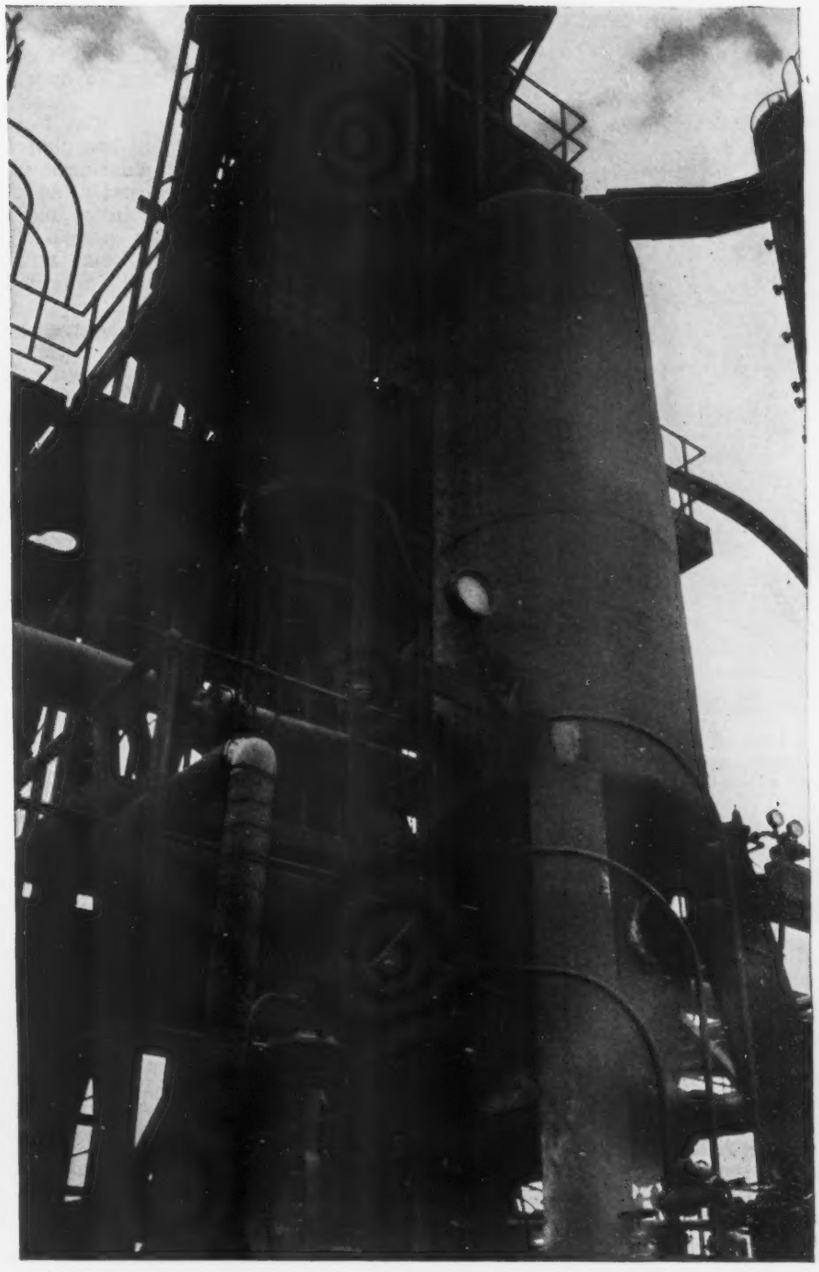


Solvent recovery distillation unit in a lubricating oil solvent extraction plant.



Towers in a 1938 solvent dewaxing unit. This shows well the trim, systematically planned construction design typical of modern refinery engineering for the new processes.

Guardians of Operating Efficiency!



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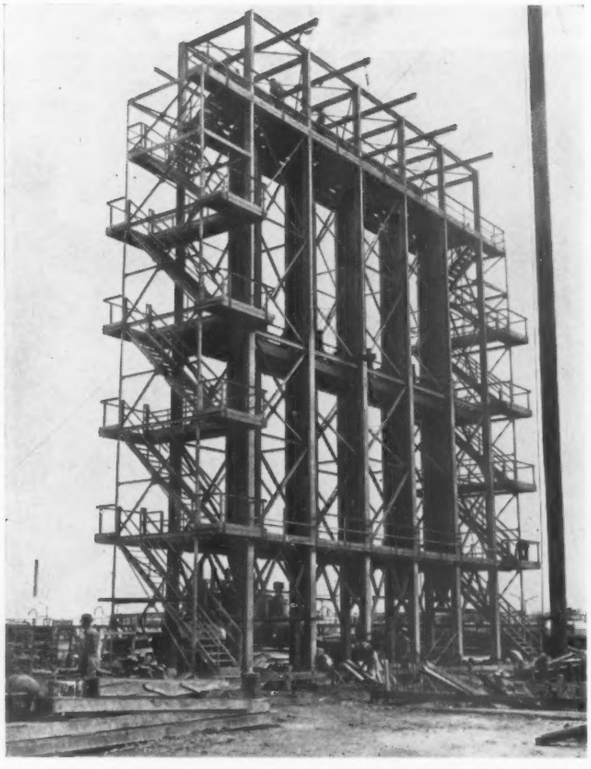


Designed to handle six million cubic feet of refinery gases per day, this most recent UOP catalytic polymerization unit at the Richfield plant shows a more open construction than earlier units of this type.

methane and ethane under pressure and isolating the hydrogen produced by the pyrolysis. Commercialization of a process for making liquid fuels from methane-ethane mixtures would become a phenomenally important part of the petroleum industry's economy.

Alkylation to combine iso-paraffins such as i-butane with olefins has been announced by Dunstan and associates (J. I. P. T., June, 1938, p. 303). The reaction is carried out by mixing i-butane with 97% sulfuric acid in a low-pressure jacketed vessel, and adding the olefin over a period of 1.5 hours with vigorous agitation, maintaining a temperature of 68° F. during the time, the pressure falling from 50 pounds to atmospheric in the reaction vessel. Four reacting units (mols) of i-butane are used per mol of butene, and yields of 73-82% of the reacting charge are obtained as saturated iso-paraffins, which are combinations of two or three of the C_4 groups. High yields of product from refinery gases may be obtained, the technologists claim, using concentrated fractions containing 50% of olefins and 70% of i-butane respectively. Other methods are under intensive study in this country, using thermal, catalytic, and combinations of the two systems, without any announced results as yet. In the fields of special fuels, for production of extremely high octane number blending naphthas and for other special purposes this type of reaction should prove invaluable when commercialized.

Space does not permit consideration of other interesting research developments, most or all of which are in the test-tube or small laboratory stages, the results of which may upset all our present estimates and calculations on refining technology. Attention must be called to the dependence of processing on metallurgy and mechanical engineering for making practicable the commercial operation of all processes involving corrosiveness or high pressures and temperatures. The development of high pressures in continuous processes waited on efficient high pressure, high capacity pumps and compressors, on high tensile strength high corrosion-resisting tubes, headers, towers, heat exchangers. These two phases of technology must progress in double harness.

Treating methods for light oils, especially for sweetening and de-sulfurizing of cracked and straight-run gasolines, have completely revolutionized that field within the last two or three years. At least four different treating methods have come to the fore recently, claiming to improve the finished product and usually at lower cost.

The Perco process for sweetening gasoline is used in two phases, the "wet" and the "dry" processes. Cupric chloride is used in water solution in the first and a solid carrier, such as fuller's earth, is impregnated with the solution for the latter, through which the liquid gasoline is percolated. The cupric salt is reduced to cuprous chloride and HCl while oxidizing the mercaptans to disulfides and later is oxidized to the cupric state for reuse, using air-blowing to effect the oxidation, that is, to rejuvenate the solution. Some difficulties have been experienced with very small quantities of copper remaining in the gasoline, which, engineers claim, has been eliminated by the use of a sodium sulfide stabilizing solution which removes the traces of copper which in earlier work caused discoloration of the product on standing.

Figures of two years ago are not too dependable for 1938 estimates on costs of treating. In one case (1936) 142,000 barrels of gasoline were treated at a cost of 0.18 cent per barrel for chemicals; a 15,000-barrel batch of copper solution then cost about $1000; sodium sulfide solution, 5500 barrels, cost then $365; extra labor cost for treating 5000-10,000 barrels per day was given as $55 per month. It is considered certain that costs since then have been appreciably reduced.

Losses in octane number of doctor-treated gasoline were reported (1937) to be up to 3.5 numbers, while the octane number of copper-treated fuel was either the same as before or increased 0.5 to 1.0 number, published data shows. (Nat. Pet. News, Oct. 7, 1936, p. 34; June 9, 1937, p. 54).

The same type of reaction is obtained, presumably, in the UOP copper sulfate method, used in a number of installations on cracked and polymerized gasolines. One main purpose of these processes, again a matter of necessity being mother to invention, is the saving of octane rating and an increase in lead susceptibility, both of prime importance in the refiner's economy. Both the above mentioned processes are recommended to accomplish these results in greater degree than doctor's treatment. The lead sulfide method is also recommended for the same reasons.

THE lead sulfide process employs preformed PbS in a strong caustic solution, with a regulated amount of sodium sulfide to precipitate the excess lead salts formed during sweetening. The reagent is activated by a regulated amount of air, and the system is operated to result in essentially a catalytic oxidation process with a minimum chemical loss due to side reactions, maintaining the strength of the caustic solution and rate of regeneration to maintain a balanced condition in the reagent for optimum, uniform results. The reagent must be revivified outside the system at from three to twelve weeks' intervals, due probably to film formation on the lead sulfide. Air requirements are from 0.15 cu. ft. to 1.0 cu. ft. per barrel depending on the sourness of the stock treated. Fresh reagent is made by adding sodium sulfide solution to the sodium plumbite solution, precipitating PbS therefrom.

Refining companies have under consideration an estimated capacity of up to 50,000 barrels per day of PbS treating units, including four or five separate installations. Units of this type have been operating in California for several years with good results in removing mercaptans, reports say.

Developments in improving the old doctor method for sweetening gasolines have been important of late years, although the new ideas are mainly in useful refinements of the original method. Centrifuge separation of the treating mixture has resulted in considerable savings of reagent and of the gasoline, which under older methods was emulsified and lost with the doctor solution.

Regenerating methods have been perfected to reduce costs and time. Caustic wash for cracked distillates has been improved to show excellent rssults, preceding doctor or other treating process, removing mercaptans and reducing the amount of after-treating necessary.

For removing sulfur from high sulfur cracked or straight-run distillates the Stratcold process has shown excellent results, it is said. It now is a combination of the earlier centrifuge-contactor system with the Halloran low temperature process. The raw product is chilled to 30° F., or any desired temperature, and contacted in special equipment with 98% sulfuric acid, the sludge being separated in special centrifuges. By this method, short contact time and complete separation immediately reduces the amount of acid needed for a given result, eliminates objectionable sludge left in the gasoline and removes sulfur from high-sulfur naphthas practically quantitatively. A 12,000-barrel unit has recently been installed on the Gulf coast, a 5000-barrel unit is building in California. At least eight units are now being considered in the country, with a total capacity of about 85,000 barrels per day, with five foreign bids amounting to 70,000,-75,000 barrels per day also being contemplated, reliable sources report.

A new patent application outlines a treating method using sodium bisulfite without, however, any actual plant data being available to show details or results obtained by its use.

Detailed information on the results of using the newer types of decolorizing, decarbonizing filter media are too voluminous to include here. Porocel is a new material, reputedly an alumina product, which is being used in several plants at low cost and with reported excellent results in greatly lowered carbon residue, oxidation stability, and low color. In spite of technical knowledge which shows that low color in itself is not necessarily an index of good qualities required in lubricants, color remains one of the primary specifications for lubricants with the trade. Carbon residue is similarly important with much more scientific reason for so being; oxidation stability is one of the most important properties in technologists' minds.

Filtrol is a synthetic or semi-synthetic product also showing high efficiency but high costs, refiners say, and its wider use is contingent on reducing the costs it is believed. Florex is an activated fuller's earth, extruded into cylindrical form in the moist state by a new development, for which a 20% greater efficiency is claimed, this higher efficiency being due to the crushing of the granules under pressure to give a greater contact surface per unit of earth. Florite is an activated bauxite which is recommended especially for making white waxes and petrolatums. Its physical resistance to attrition and therefore its low dust loss is claimed to extend its use life indefinitely. X-yte is the graded, standardized form of bauxite prepared to definite efficiency standards at the mines in Arkansas, which is being used in an increasing number of plants and offers good possibilities, some users believe, for certain purposes throughout the industry. Little data have been obtained on the comparative efficiency of this product. One test on Pennsylvania oil shows about 25% lower carbon residue and slightly higher viscosity index when using X-yte compared to fuller's earth. Bauxite of this type is claimed to have a longer "on stream" life, 41 hours to 24 hours, compared to fuller's earth.

No attention can be given here to many processes in the development stage at present. Chemical syntheses in California and on the East Coast are producing a large number of solvents, chemicals of several types, by processes which are closely guarded secrets, patents covering which are in most cases not yet issued. Yet these processes may well affect seriously the economics of the refinery of tomorrow. The statement made in former years that the refinery is fast becoming a chemical factory is more true now than ever. In many instances this is an actual commercial fact.

The chemistry of petroleum and its refining has only been scratched. We are now merely in a position to begin to really learn something of the chemistry of refining petroleum products.

Tulsa S.A.E. Program On Fuels, Lubricants

NEW YORK, Sept. 3.—No more fitting location for a meeting on fuels and lubricants can be found than Tulsa, where the Society of Automotive engineers will hold its fall regional meeting of the Fuels and Lubricants Activity Oct. 6-7, under the general direction of B. E. Sibley, vice-president of the society. The meeting will stress especially operation and maintenance, qualities of fuels and lubricants and new automotive developments as they affect these products.

Six sessions will make up the meeting, four technical meetings during the two days and a dinner each evening. One of the interesting features will be a debate the evening of Oct. 7 on the question of rear engine vs. forward engine monuting for passenger cars. Teams from Kansas State College and from the University of Oklahoma will present the affirmative and the negative arguments respectively.

Wm. F. Lowe secretary of the Natural Gasoline Association of America is general chairman, with J. V. Brazier, Barnsdall Refineries, Inc., as local chairman of the meeting committee, J. A. C. Warner, general manager of the S. A. E., announces. Serving with these two men are T. J. Schuetz, Braden Winch Co., A. V. Bourque, secretary of the Western Petroleum Refiners Assn., C. A. Tangner, Downtown Chevrolet Co. of Tulsa, and G. C. Richardson, Indian Territory Illuminating Oil Co.

The full program is announced below.

Morning, Oct. 6, A. V. Bourque, chairman

Motor Tuneup and Servicing—L. L. Fawcett, Auto Electric Service.

Four Ball Testing Apparatus—Bataafsche Petroleum Maatschappij, Proofstation Delft.

Afternoon, Oct. 6, Ralph Matthews, chairman

Motor Transportation Paper—Representative of Southwestern Bell Telephone Co.

Operation and Maintenance Problems—Relative to Fuels and Oils—Robert Collins, Kansas City Power and Light Co.

Dinner, Oct. 6, Seven P.M., Mayo Hotel, W. F. Lowe, chairman

Oil Industry Automotive Maintenance Problems—G. L. Wheatley, Petroleum Motor Transportation Assn.

Morning, Oct. 7, T. J. Schuetz, chairman

Developing Trucks and Trailers for Portable Well Drilling Work—John D. Gordon, Dart Truck Co.

Multi-Cylinder Engine Adaptations in Oil Industry—H. W. Ladd.

Afternoon, Oct. 7, Earle W. Pughe, chairman

Characteristics Relative to Ring Sticking and Engine Cleanliness of Mid-Continent Lubricating Oils—Representative of Western Petroleum Refiners Assn.

Methods of Oil Temperature Control—F. M. Young and W. R. Ramsaur, Young Radiator Co.

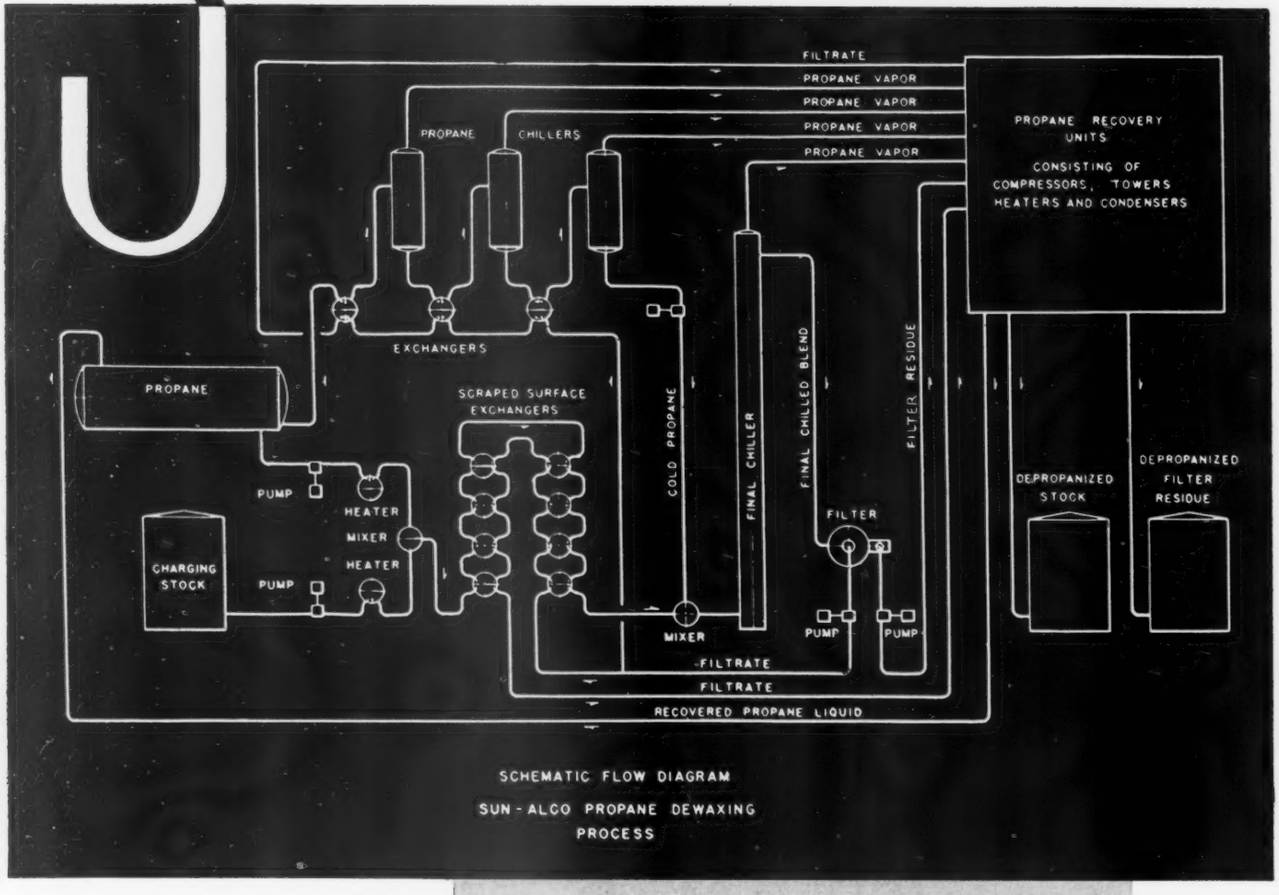
Dinner, Oct. 7, Seven P.M., Mayo Hotel, Frank A. Suess, chairman

Debate: *Resolved:* That Rear Engine Mounting is More Desirable Than Forward Engine Mounting for Passenger Cars.

Affirmative: Student Representatives, Kansas State College Department of Mechanical Engineering.

Negative: Student Representatives, College of Engineering, University of Okla.

3 POINTS OF



SCHEMATIC FLOW DIAGRAM
SUN-ALCO PROPANE DEWAXING PROCESS

1 **Continuous Chilling**

2 **Indirect Chilling of Low Propane Dilution Blends**

3 **Simultaneous Dewaxing, Deresining and Deasphalting**

ADVANTAGE..

Sun-Alco Propane Dewaxing

Sun-Alco Propane Dewaxing presents three distinct advantages:—

1. Continuous Chilling Versus Batch Chilling
2. Indirect Chilling of Low Propane Dilution Blends Versus Auto-Evaporative Chilling of High Propane Dilution Blends
3. Simultaneous Dewaxing, Deresining and Deasphalting, Versus Separate Steps

Blends vary from 1 part propane and 9 parts charge oil for wax distillate stocks to 5 parts propane and 1 of charge oil for residual stocks. The original blend is continuously chilled by indirect exchange refrigeration to effect approximately 90% of the total blend chilling, is brought to final dilution by the addition of cold propane, and is auto-refrigerated to the final temperature.

Dewaxing, Deresining and Deasphalting of the final blend is accomplished simultaneously in a single step.

Indirect chilling, cold propane dilution, final chilling, and simultaneous dewaxing, deresining and deasphalting of the blend under controlled conditions result in Fast Chilling, Efficient Recovery of Refrigeration, High Filtering Rates, High Oil Recovery, Better Deresining and Continuously Uniform Results.

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Dehydrogenation of Lower Paraffins

By J. Burgin,* H. Groll* and R. M. Roberts*

ABSTRACT

Catalytic dehydrogenation for the production from the lower paraffins, of the lower olefins as base materials for synthetic gasoline and chemical products has been accomplished by the use of an alumina carrier, activated by various metal oxides. I-butane is reduced to i-butene in 72% yield at 600° C. A higher temperature gives lowered yields. Propane, n- and i-butanes have been dehydrogenated.

A slight amount of water—referred to as a monomolecular layer—on the catalyst is necessary for reaction; absence of water kills the reaction.

Chrome oxide, vanadyl sulfate, iron and zinc oxides, and reduced nickel are mentioned as catalysts, of which chrome oxide shows the highest conversion rate.

Conversion percentages for these hydrocarbons vary from 22.0 for n-butane to 37.4 for propane, under different temperature and catalyst composition conditions.

THE lower molecular weight paraffins and olefins that form in large quantity during the cracking operation were at first considered by the petroleum industry as undesirable by-products, which could be used at best as fuel. However, with the increasing development of processes for the manufacture of synthetic chemical and gasoline products from the lower olefins, the situation has gradually changed so that the time is not far distant when a shortage of certain of these olefins may be expected.

In anticipation of such a shortage, extensive work has been conducted in these laboratories over a number of years on processes for increasing the supply of olefins. The present paper deals with one of these processes, the catalytic dehydrogenation of propane, normal butane, and isobutane.

Thermal vs. Catalytic Reaction

In the pyrolysis of hydrocarbons the splitting of the carbon to carbon bond predominates and little control is obtained of the final reaction product. Thus when propane, normal butane or isobutane is subjected to pyrolysis, considerable quantities of lower paraffins and olefins, as well as carbon and hydrogen, are produced, and dehydrogenation to an olefin of the same number of carbon atoms takes place to an unsatisfactory degree.

Equilibrium data show that olefin formation by dehydrogenation should be extensive at temperatures where breaking of carbon to carbon bonds occurs only to a small degree; theoretical conversions, calculated from previously determined[4, 5] equilibrium values are shown graphically in Fig. 1. Thus with a suitable catalyst it would be possible to selectively accelerate the dehydrogenation reaction at the expense of the other pyrolytic reactions.

In selecting a catalyst, cognizance must be taken of the thermal stability of the hydrocarbon, for this will affect the allowable temperature of operation. Of the three hydrocarbons studied, propane is the most stable, followed by isobutane and normal butane[3].

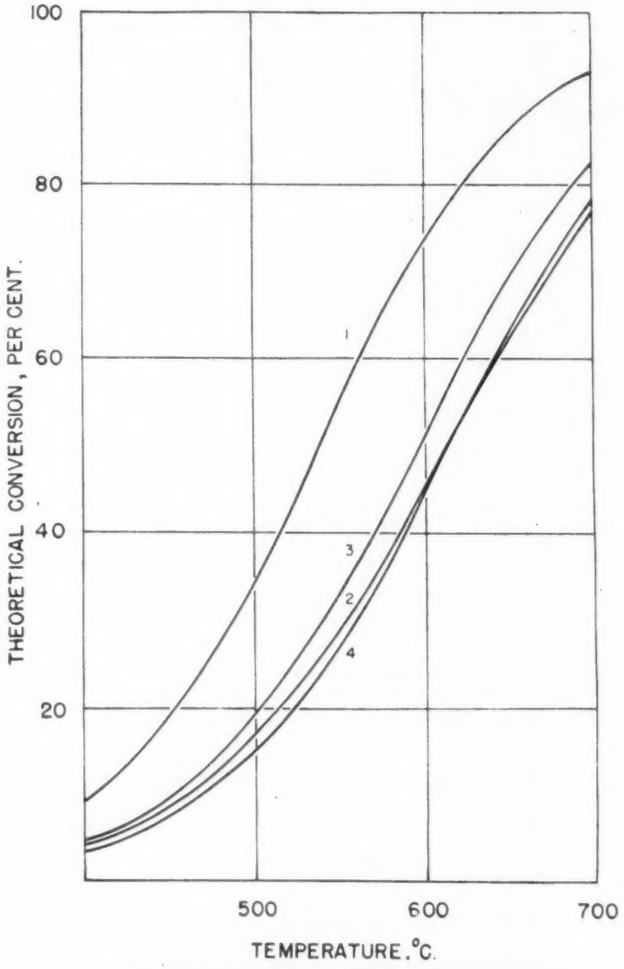


Fig. 1. Dehydrogenation of Paraffin Hydrocarbons (Equilibrium curves)
Curve 1. Isobutane to isobutene.
Curve 2. n-Butane to trans-2-butene.
Curve 3. n-Butane to cis-2-butene.
Curve 4. Propane to propene.

Experimental Procedure

The experimental work was carried out with propane, normal butane, and isobutane of 95% to 98% purity, prepared by fractionation from petroleum gases. These hydrocarbons were passed through a drying tube containing calcium chloride and then through a quartz reaction tube containing the catalyst under examination; the reaction tube was heated in either a gas or an electric furnace. The

* Shell Development Co., Emeryville, Calif.

Over Activated Alumina Catalysts

gas flow and temperature were measured by standard methods. The gases were analyzed by acid absorption or by Podbielniak distillation. Conversions were calculated from the gas analyses and the relative volumes of feed and effluent gases. The ratio between the amount of the desired olefin and that of the total olefins formed presents a ready means of following the efficiency of the dehydrogenation reaction, provided cracking to carbon is not extensive.

Characteristics of Dehydrogenation Catalysts

The activity of a dehydrogenation catalyst depends not only on its chemical composition but also on its physical structure. A compound can be quite inactive in one form or very active in another; the method of preparation is therefore of importance. It is often difficult to obtain a structure which is capable of catalyzing dehydrogenation; a carrier or active support possessing the required physical structure may render such a compound active.

It has been found that active dehydrogenation catalysts possess a high adsorptive capacity. However, this does not imply that a material having high adsorptive properties is necessarily an active catalyst. Activated carbon[5] and activated alumina are examples of materials having both high adsorptive capacity and high selective dehydrogenation activity. On the other hand, silica gel, which has a high adsorptive capacity, has shown very little activity as a dehydrogenation catalyst.

The presence of small amounts of water vapor, preferably introduced with the feed, *is essential for practical dehydrogenation activity.* Many experimental results show that a dehydrogenation catalyst is active only when covered by a monomolecular layer of water[3]. The water may be substituted by hydrogen sulphide or a combination of the two gases[4].

The active period of a catalyst is limited by many factors, such as clogging of the pores (for example, by carbon and tar), disruption of the physical structure (by excessive temperatures), and poisoning by foreign chemical compounds. A catalyst can generally be regenerated if its physical structure has not been destroyed.

Activated Alumina as Dehydrogenation Catalyst

The particular form of activated alumina which has been found satisfactory as a catalyst for dehydrogenation is a commercial product of very porous structure, sold as a drying agent. This alumina is made by calcining a specially crystallized alumina trihydrate. In the laboratory an activated alumina which compares well with the commercial product was prepared by dissolving aluminum in sodium hydroxide and precipitating aluminum hydroxide from the solution by means of carbon dioxide gas; the resulting precipitate was carefully washed and dried at 600° C. (1112° F.)[6].

Table 1. Dehydrogenation of isobutane over activated alumina

(*6-hour composite samples*)

Temperature, degrees Cent.	600	650
Space Velocity, per minute	3.3	35
Isobutane Reacted, per cent by weight	44.1	35.5
Conversion to Isobutene, per cent	31.6	17.5
Yield, per cent by weight:		
Hydrogen	4.2	2.4
Methane	6.6	5.2
Ethylene	0.6	0.8
Ethane	0.0	2.0
Propene	5.6	10.9
Propane	1.3	6.1
Isobutene	71.9	57.2
Carbon	9.8	15.4

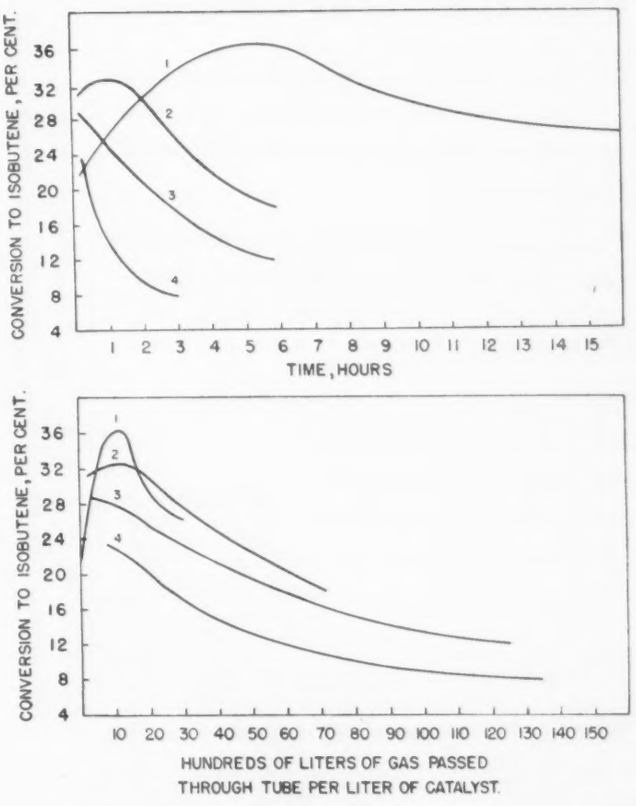

CONVERSION TO ISOBUTENE, PER CENT.
TIME, HOURS
CONVERSION TO ISOBUTENE, PER CENT.
HUNDREDS OF LITERS OF GAS PASSED THROUGH TUBE PER LITER OF CATALYST.

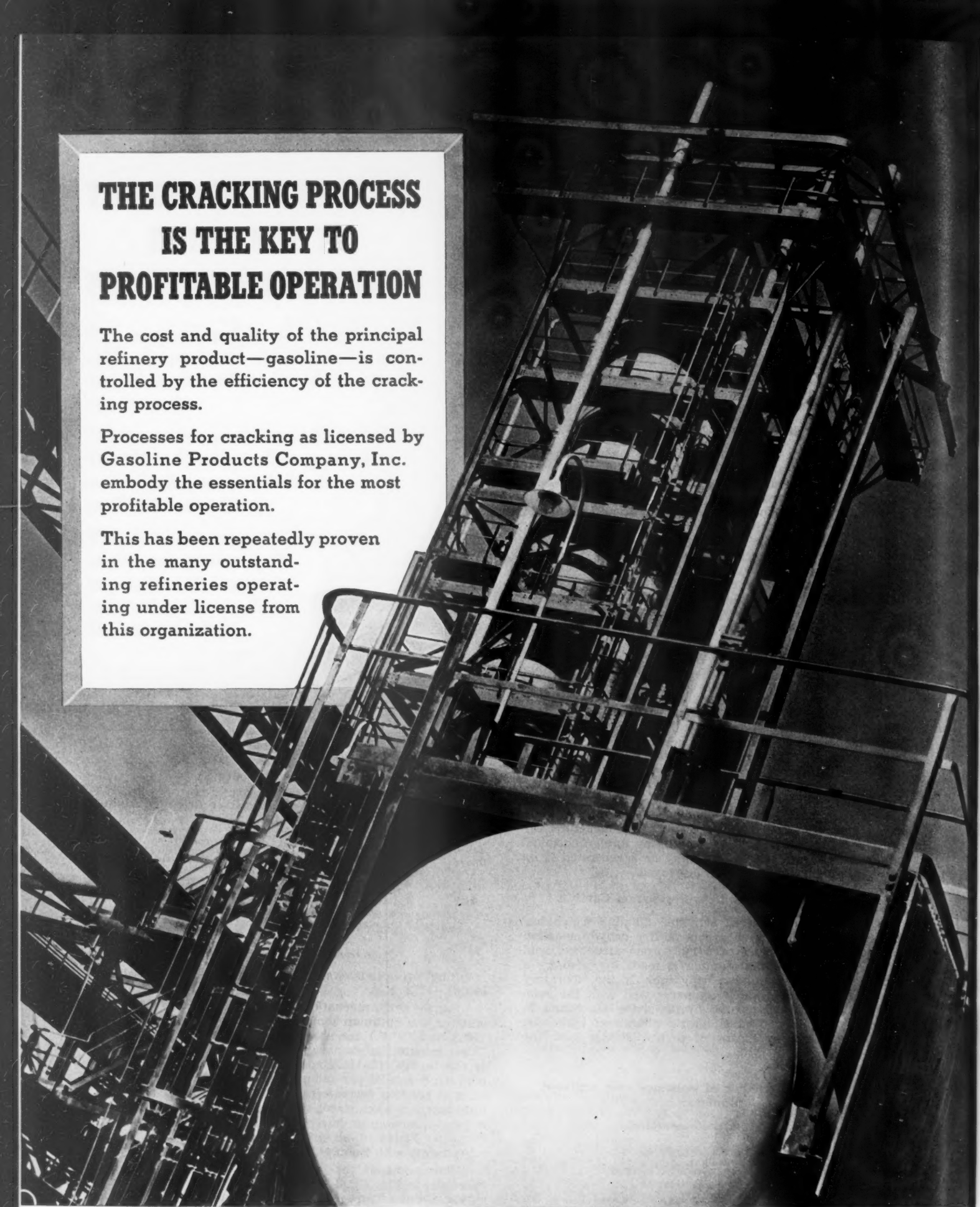
Fig. 2. Dehydrogenation of Isobutane Over Activated Alumina Catalyst

Curve	Temp. °C.	Space velocity per min.	Ratio*	Duration of run	% Average conversion to isobutene	Production†
1	600	3.3	.80	16 hrs.	29.8	944
2	650	20	.74	6 hrs.	25.0	1800
3	650	35	.71	6 hrs.	17.6	2218
4	650	76	.71	3 hrs.	12.0	1642

*Isobutene to total olefins.
†Liters of isobutene gas per liter of catalyst.

For the dehydrogenation of isobutane over this activated alumina the optimum temperature range is 585 to 650° C. (1085 to 1202° F.) for space velocities ranging from 2 to 75 per minute; for propane the optimum temperature range is 625 to 650° C. (1157 to 1202° F.) for space velocities between 5 and 20 per minute. At lower temperatures the rates of reaction decrease rapidly; at 550° C (1022° F.) very little reaction takes place. As the temperature is increased, reactions leading to lower olefins, carbon, and hydrogen increase. Yields of all products from two representative experiments with isobutane are listed in Table I.

The course of the dehydrogenation is illustrated for isobutane in Fig. 2 and for propane in Fig. 3. In the upper curves of these figures the conversion is shown as a function of time; and in the lower, as a function of the total amount of hydrocarbon which has passed through the reaction tube. From Fig. 2 it will be seen that (after an induction period) the highest conversion to isobutene is obtained at the



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lowest space velocity (and temperature) and that the activity of the catalyst at this low flow decreases only slowly; experiments have shown that the conversion to isobutene does not fall below 20% over periods of 60 to 100 hours. There is, however, a much greater production of isobutene per unit period of time per unit volume of catalyst when high space velocities are employed, but in this case the activity of the catalyst decreases more rapidly, necessitating more frequent regeneration. The choice of space velocity thus depends upon the relative importance of these factors in the given application. Propane, as may be seen from Fig. 3, behaves somewhat similarly, but the effect of space velocity on percentage conversion and decline of catalyst activity is much less pronounced; hence in this case high space velocities have a very definite advantage.

As mentioned above, the presence of a small but finite amount of water vapor in the hydrocarbon feed is of the utmost importance for successful catalytic dehydrogenation. In the case of activated alumina catalyst, the optimum water content of the feed is of the order of 0.1 mol.%; and this value is approximated by passing the moist feed over calcium chloride. When a feed is dried more thoroughly (for example, by means of phosphorus pentoxide) there is a definite decrease in the activity of the catalyst; and intensive drying (by means of triphenyl methyl sodium) results in complete loss of activity[2]. Moisture content higher than the optimum also leads to a rapid decline in catalyst efficiency. These facts are illustrated in Fig. 4, where the maximum conversion, which may be taken as a measure of the activity of the catalyst is plotted against the molal concentration of water in the feed. The close regulation of water content is probably necessary not only to enable formation of a layer of water molecules on the surface of the catalyst, but also to maintain the alumina in the proper state of hydration. A similarly close relation has been found[1] between the water content of activated alumina and its adsorptive capacity toward hydrogen sulphide; this is of interest in view of our observations (discussed below) regarding the close parallelism between the adsorptive capacity of activated alumina for hydrocarbons and its activity as a dehydrogenation catalyst.

While activated alumina is a good dehydrogenation catalyst in itself, its greatest usefulness lies in the fact that it is an excellent carrier or support for materials

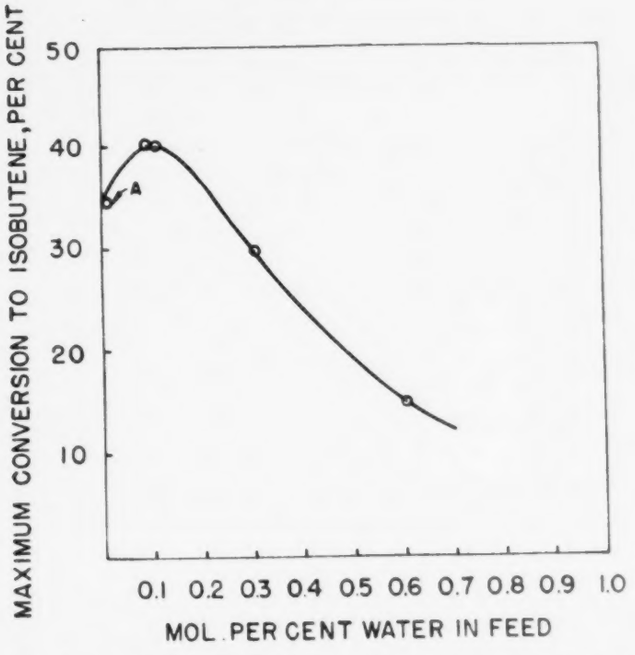

Fig. 4. Influence of Water Vapor on the Dehydrogenation of Isobutane over Activated Alumina

Space velocity, 3.3 per minute
Temperature, 600° C.
Point A represents feed dried over P_2O_5

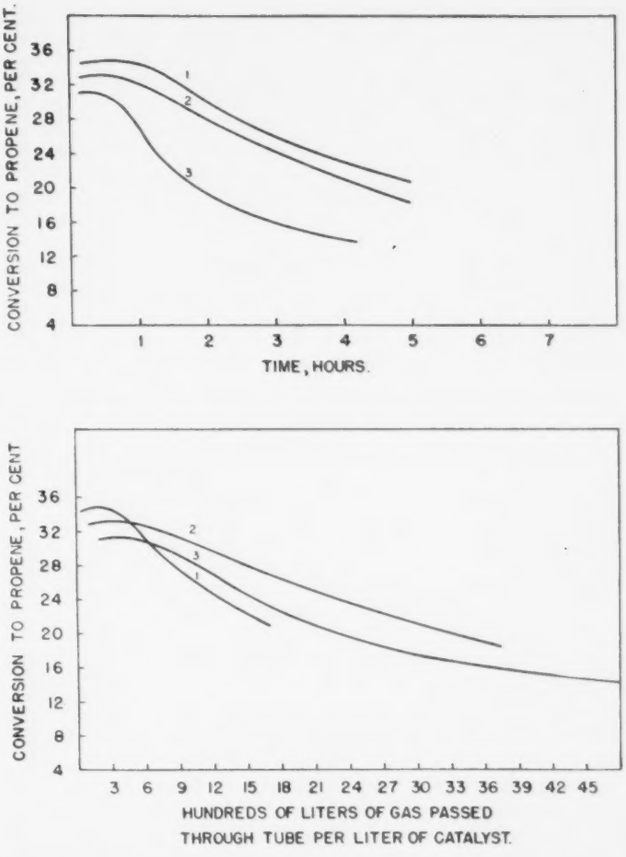

Fig. 3. Dehydrogenation of Propane Over Activated Alumina Catalyst

Curve	Temp. °C.	Space velocity per min.	Ratio*	Duration of run, hours	Av. conversion to propene per cent	Production†
1	650	5.7	.84	5	28.1	480
2	650	12.5	.86	5	25.8	968
3	650	20.0	.87	4	20.9	1002

*Propene to total olefines.
†Liters of propene gas per liter of catalyst.

which are chemically active but do not possess the physical structure necessary for a successful dehydrogenation catalyst.

When other catalytic substances are placed upon activated alumina the dehydrogenation properties of the carrier and catalyst are combined. The degree of this change depends on the specific dehydrogenation properties of the added material and upon its concentration on the alumina.

When activated alumina is used as a carrier, it is impregnated with a solution of the desired compound. A successful procedure is as follows: The alumina is heated under reduced pressure to 200° C. (392° F.) to expel the adsorbed air. It is covered with the impregnating solution and then cooled before releasing the vacuum. The impregnation can also be accomplished by letting the carrier stand for some time submerged in the solution at room or elevated temperatures[7].

In many cases activated alumina improves the stability of the dehydrogenation catalyst which it supports. For example, chromium oxide in the form of an active gel is a selective dehydrogenation catalyst at about 400° C. (752° F.) giving conversions approximating equilibrium conditions. However, these conversions are low, because the equilibrium at such a low temperature does not favor the olefin (Fig. 1); from this standpoint it would be well to operate at higher temperatures. However, this catalyst is unstable at 500° C. (932° F.) or higher. Since activated alumina has an appropriate structure which is stable above 500° C., it constitutes a very suitable carrier for chromium oxide, or for other catalysts.

Some contact materials are such active catalytic agents

that the reaction is carried too far, so that splitting of the carbon to carbon bond occurs. Mounting such catalyst on the activated alumina carrier modifies this activity. For example, reduced nickel oxide on pumice is very active but causes complete cracking to carbon and hydrogen at temperatures as low as 450° C. (842° F.), whereas nickel on activated alumina gives favorable conversions and ratios. Similarly, iron oxide when prepared as an active gel favors disruption of the hydrocarbon molecule, but is a selective dehydrogenation catalyst when supported by activated alumina.

Catalysts consisting of reduced nickel, oxide of chromium, iron, vanadium, and zinc, and many other active materials, supported on activated alumina have been tested. Representative results, listed in Table 2, illustrate the suitability of activated alumina as a carrier.

Table 2. Dehydrogenation of isobutane with activated alumina and added compounds

(*Space velocity* 3.3 *per min.*)

Added compound	Temp. °C.	% Conversion to Butene Maximum	% Conversion to Butene 3 hr. Av.	Ratio*
None	600	36.2	32.0†	.80
Chromium Oxide	550	38.0	36.2	.90
Vanadyl Sulfate	550	33.0	31.0	.89
Iron Oxide	550	37.2	35.2	.85
Zinc Oxide	600	35.2	26.7	.75
Reduced Nickel	500	14.9	....	.90

*Isobutene to total olefins. †12-hour average.

Chromium Oxide on Activated Alumina

Chrome-alumina catalysts are prepared by impregnating activated alumina with an aqueous solution of chromic acid or one of its salts, such as sodium or potassium chromate or bichromate. Catalysts prepared with alkali chromium salts give most satisfactory conversions with concentrations of about 2% chromium; if the salt content is increased beyond the optimum figure the activity of the catalyst decreases owing to the increasing formation of an alkali aluminate.

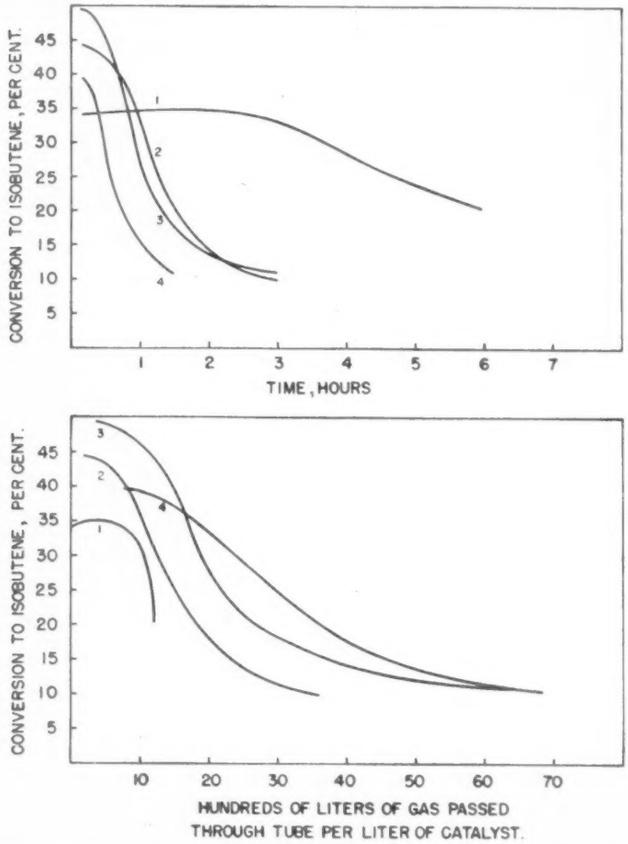
CONVERSION TO ISOBUTENE, PER CENT.
TIME, HOURS
CONVERSION TO ISOBUTENE, PER CENT.
HUNDREDS OF LITERS OF GAS PASSED THROUGH TUBE PER LITER OF CATALYST.

Fig. 5. Dehydrogenation of Isobutane over Chrome-Alumina Catalyst (12.7% Cr)

Curve	Temp. °C.	Space velocity per min.	Ratio*	Duration of run, hours	% Average conversion to isobutene	Production†
1	550	3.3	.91	6	30.5	366
2	550	20	.83	3	25.0	899
3	575	35	.83	3	24.3	1532
4	625	76	.78	1½	21.6	1478

*Isobutene to total olefins.
†Liters of isobutene gas per liter of catalyst.

The presence of alkali may be avoided by the use of chromic acid or chromium nitrate in the preparation of the catalyst. In this manner, on raising the chromium concentration to 10 or 20%, a catalyst is obtained which is active at temperatures 50° to 70° C. (122° to 158° F.) lower than for activated alumina containing little or no chromium oxide. This flexibility is of advantage, because it enables a choice of catalyst to suit the particular hydrocarbon from the standpoint of equilibrium and thermal stability. For example, normal butane, which is less stable thermally than isobutane or propane, is best dehydrogenated by means of a catalyst of high chromium concentration, which is active at lower temperatures. Propane, which is stable at higher temperatures, is on the other hand preferably dehydrogenated by means of a catalyst of lower chromium concentration.

Fig. 5 gives conversion data for isobutane using a chrome-alumina catalyst containing chromium oxide (12.7% Cr.). In comparing the conversion curves for this catalyst with the conversion curves for plain activated alumina (Fig. 2), two important points may be noted: first, that the temperatures are lower and, second, that the runs are shorter in duration. However, higher initial conversions, better ratios of isobutene to total olefins and higher yields result with the chrome-alumina catalyst. The yields are 75% to 80% at space velocities between 20 and 75 per minute and corresponding temperatures in the range 550° to 600° C. (1022° to 1112° F.).

A comparison of the behavior of the three hydrocarbons over representative alumina catalysts, with and without chromium oxide, is given in Table 3. Suitable operating temperatures were selected in each case for the particular hydrocarbon feed and catalyst, at a uniform space velocity of 20 per minute. The conversions and ratios of olefins are average values over the periods of time listed; these periods correspond roughly, as may be seen by comparison with Fig. 2, 3, and 5, to those during which the catalysts are reasonably active, and therefore to practical lengths of runs, at this space velocity.

Table 3. Dehydrogenation of propane, normal butane and isobutane with alumina type catalysts

(*Space Velocity* = 20 *per minute*)

	Activated Alumina 3-hour period	Act. Alumina + 2% Cr 1½-hour period	Act. Alumina 12-15% Cr 1-hour period
Propane			
Temperature, deg. Cent.	650	625	575
Average conversion to isobutene, per cent	23.6	37.4	25.8
Average ratio of propene to total olefins	.87	.95	.95
Normal Butane			
Temperature, deg. Cent.	650	625	550
Average conversion to isobutene, per cent	*	22.0	30.1
Average ratio of normal butene to total olefins	*	.60	.97
Isobutane			
Temperature, deg. Cent.	650	625	550
Average conversion to isobutene, per cent	31.0	35.5	37.0
Average ratio of isobutene to total olefins	.74	.78	.83

*Excessive decomposition to carbon and hydrogen; in the other eight examples, carbon formation was only 1 to 4 per cent (feed basis).

Experiments have shown that the catalytic activity of activated alumina closely parallels its adsorptive capacity. Hence in view of the change in activity produced by adding chromium compounds to activated alumina, tests of adsorptive capacity have been extended to these catalysts.

These measurements, summarized in Fig. 6, show that the more active catalysts have the greater adsorptive capacity. The presence of an alkali radical in high concentrations (for example, from the use of sodium bichromate), which as above stated is detrimental to the activity of the catalyst, is also detrimental to the adsorptive capacity (compare curves 4 and 5 with curve 3). On the other hand, the introduction of chromium as chromic acid

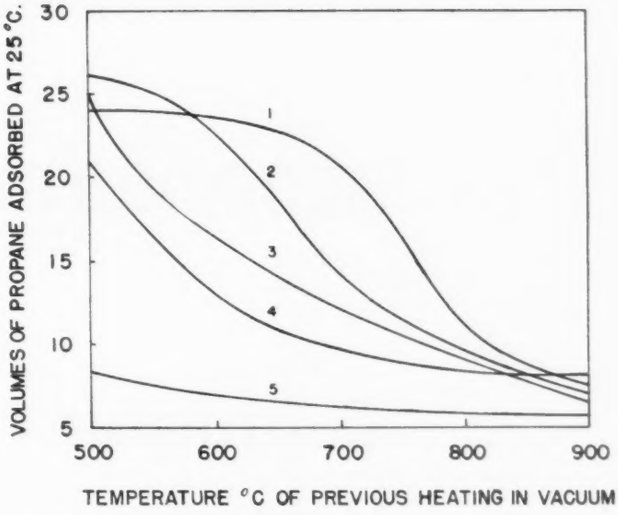

Fig. 6. Adsorptive Capacity of Alumina Type Catalysts

Curve	Catalyst	% Cr
1	Chromic Acid Alumina	15.1
2	Chromic Acid Alumina	1.9
3	Activated Alumina	0.0
4	Sodium Bichromate Alumina	7.5
5	Sodium Bichromate Alumina	15.0

materially improves the adsorptive capacity (curves 1 and 2). The addition of 15.1% chromium, as chromic acid, produces a catalyst which does not materially decrease in adsorptive capacity until heated to temperatures in excess of 700° C. (1292° F.).

Regeneration of Catalysts

The activity of these catalysts declines as a result of the accumulation of carbon upon the surface and in the pores of the catalyst during the dehydrogenation process. To restore the original activity of the catalyst, this carbon deposit must be periodically removed. The removal is best accomplished by treating the catalyst at a temperature of 600° to 700° C. (1112° to 1292° F.) with a stream of air. The heat of combustion is sufficient to cause a sharp rise in the temperature of the catalyst bed and the air flow must be carefully controlled in order to keep the temperature within safe limits, of the order of 700° C. The time necessary for regeneration can be reduced to one-half or one-third (without at the same time permitting excessive temperatures) by diluting the air with an inert gas such as nitrogen or carbon dioxide, or in some cases, steam; these diluents serve to increase the rate of removal of the heat generated in the tube [6, 7].

In actual practice the course of the regeneration may be followed by the course of the "hot spot" or combustion zone which progresses from the inlet end of the tube to the exit end. When this "hot spot" reaches the exit end, there is a sharp decline in temperature and decrease in the carbon dioxide content of the effluent gas; the catalyst is then ready for re-use.

Both the plain activated alumina and the chrome-alumina catalysts have been regenerated in this manner over 200 times with very little loss in activity.

Patents

Various features of these processes are covered by patents and pending applications in the United States and abroad.

Acknowledgment

The authors wish to express their appreciation to Messrs. F. F. Rust and C. O. Hurd for their assistance in this work, and to the Shell Development Co. for permission to publish this paper.

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Activities

OF EQUIPMENT MANUFACTURERS

SALTS IN CRUDE—"The general problem of determination of salts in crude oils comprises, in reality, two entirely separate and distinct problems," according to C. H. Roberts and R. W. Stenzel in a series article on this subject which has appeared in recent issues of The Electric Dehydrator, published by Petroleum Rectifying Co. of California. In addition to the complete extraction of salt from the oil, which is the first problem, is the problem of estimating in the aqueous extract the kinds and quantities of various substances present to be extracted.

The first problem is emphasized because of difficulties of extraction processes in heterogeneous systems and the fact that crude oils contain naturally occurring emulsifying agents whose presence hinders solution of the salts in the extraction medium and impedes its complete separation and recovery for subsequent analysis.

The article summarizes methods for extraction of salts from crude and methods for analysis of aqueous extract. The third and concluding part of the series deals with analytical methods. Complete copies of issues containing the series are available from the company, 714 Security Title Insurance Bldg., 530 W. Sixth St., Los Angeles.

* * *

STEEL EXHIBIT — United States Steel Corp. subsidiaries will present at the National Metal Exposition in Detroit, Oct. 17-21, a joint exhibit for the American Steel & Wire Co., Carnegie-Illinois Steel Corp., Columbia Steel Co., National Tube Co., Scully Steel Products Co. and Tennessee Coal, Iron & Railroad Co.

A central structure will provide two interior booths, one containing a 50-seat theater where a Technicolor movie describing the manufacture and uses of Cor-Ten steel will be shown. The opposite space will feature graphically some of the newer concepts of hardenability and an exhibit of the Austempering process.

* * *

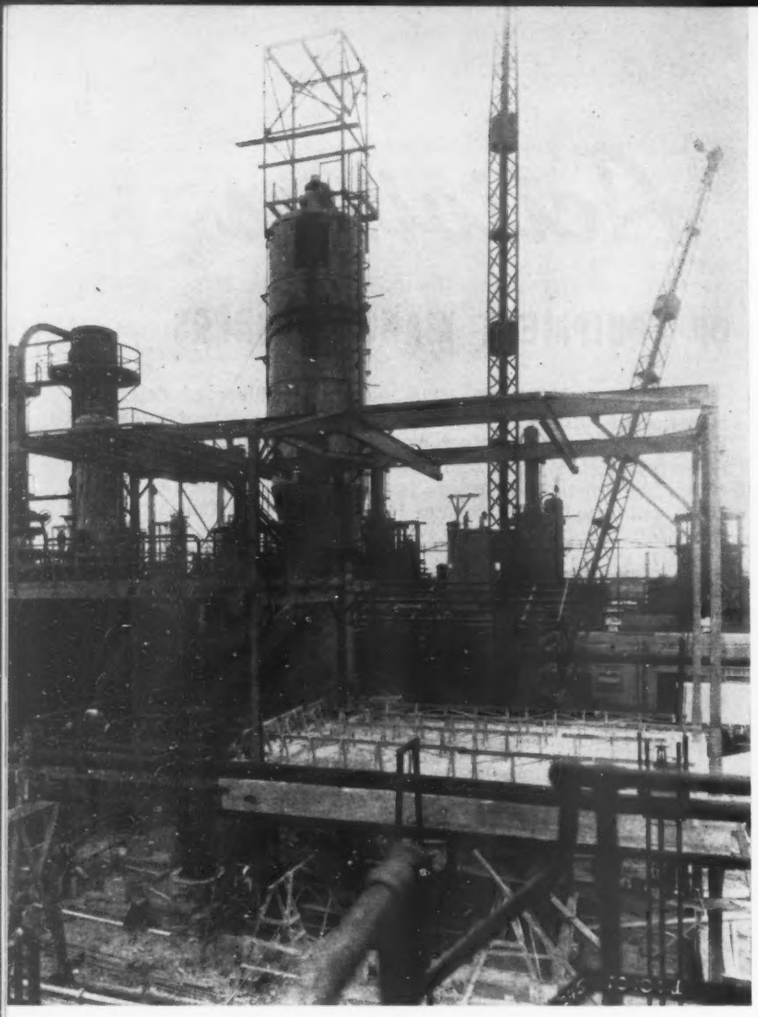
OIL ADDITIVE — One of the oil additive compounds (152) of the Alox Corp. has been improved so that it is completely soluble in hydrocarbon oils. This means that blending with this compound now consists merely in heating oil and compound and adding the requisite amount of compound without the manufacture of concentrates and settling or filtering.

* * *

REFINERY CONSTRUCTION — E. B. Badger & Sons Co. of New York, Boston, and San Francisco, has just issued an 8-page brochure covering the scope of the company's operations, which includes the designing of complete plants for petroleum refining or equipment for any process. One page covers the line of Badger packless expansion joints of three basic designs.

* * *

FLOW CONTROL — A new 38-page bulletin under this title issued by the Foxboro Co., Foxboro, Mass., contains application data on instruments for control of flow in numerous industrial processes, including oil refining. Beginning with a discussion of the theory of flow control, the bulletin goes on to describe the Stabilog flow controller. The principles of throttling control and automatic reset are described and, for use with air-operated control instruments, the Stabilflo valve and its operation are explained. Copies of the bulletin, No. 170-1, may be obtained by writing the company.



The speed of modern construction in America amazes the rest of the world. A 12,000-barrel rerun unit at the plant of Gulf Refining Co. at Port Arthur, Texas, is shown 80 days after the building contract was signed with Foster Wheeler Corp. Fifty-five days later the plant was finished and ready to operate.

$200,000,000 In

Estimated for C

A "NEW construction" estimate of $200,000,000 may seem like a large order for the refining industry in this country to fill by June 30, 1939, but that's the way the individual estimates of the majority of the refining companies, large and small, total up when run through the adding machine. Maybe business in general may take a "left-hand twist" to clamp the lid on a good portion of that projected expenditure, as happened in several instances last fall, when sales curves started down but that seems hardly likely now.

Anyway, that is part of our anchor to win'ard as a business prophet. And the figure mentioned sounds reasonable after talking with many executives each of whose names, signed to orders, start action in a dozen places at once. One good sign is that, since talking with these men, some of them several weeks ago, a large portion of this spending has already started. When one refining company starts building nearly a dozen units, units very important in the economy of not only that large company but for the industry in general, it is no penny-ante game. Also when another large company announces publicly it will spend money in eight figures (tens of millions to you) on refinery and auxiliary expansion and rehabilitation, the chips aren't any cheaper.

Some of the reasons for this expenditure we have attempted to outline in other articles in this issue. The refiner's picture is complex and yet very simple. It is only that he must have and operate processes and equipment which will enable him to compete with other refiners, in high product qualities, in high yields, in low losses and in low overall operating costs—it sounds very simple.

It is complex because never before has he faced so many processes from which to choose; nor has he before faced so many efficient processes and equipment assemblies, operating in his competitors' plants. Treating processes have concentrated on low losses of material and of those qualities most indispensable—octane number, volatility, low gum—and the loss of one or two octane numbers in cracked gasoline may break the refiner's back buying more lead or in lowered yields sustained in cracking to a higher initial octane number. By wasting his cracked gases to plant fuel gas, instead of polymerizing them, a loss in gasoline yield of 2% of the crude may kick him out of the black into the red.

When the difference between operating costs of the older, *separate* topping-cracking-reforming-rerunning operations and the modern combination types of distillation Juggernauts is that between 26-27 cents per barrel on one hand and 19-20 cents per barrel on the other—a mere matter of about 35-36% over the lower cost—lots of hard-headed thinking will be done. When the gasoline yield difference is that between, say 52-54%, producing difficultly salable fuel oil or piling it up in already overloaded tanks, and 66-70% to the same specifications, with a small percentage of solid coke residue which may even be thrown away without serious loss, or sold as domestic or industrial fuel—plenty more hard thinking will be done.

In mentioning the types of units which are building and will be built during the present fiscal year, most of them have not yet reached the stage of public announcement and cannot be identified. At least a half-dozen polymerization units have been definitely scheduled, most of them of large capacity. Whether or not they will actually be built in some cases will depend on the trend in octane numbers in motor fuel sold in the country.

The east coast, the west coast and the Gulf coast may expect the largest expenditures especially in cracking, polymerization, hydrogenation facilities. Recent reports show conclusively that, in spite of the fact that the refiner cannot expect a compensatingly higher price for his gasoline, the octane number of competitive regular grades is being forced by competition, not consumer demand, to touch the higher maximum for "Q" motor fuel, and in a large percentage of cases to exceed that "maximum." A survey of a dozen competitive regular grades in an Eastern city recently showed three of them to be between 74 and 75

739.3

In Plant Building

Coming Months

Nichols-Herreshof earth burner; not a new development but an improved method of revivifying filter media to extend its useful life, found in a large number of refineries.

octane number (L-3 method), six between 72 and 73, and only three at 72 and below. Surveys in the Mid-Continent showed that most refiners are holding their fuels at slightly above or slightly below 72, L-3. Competent observers believe that those samples above that figure are high because some leeway is allowed at the refinery for volatility and therefore octane number loss between refinery and filling station, and that no refiner is purposely exceeding the maximum, a healthy attitude on the refiner's part.

In a midwest city, well known for the price wars which have made it a black spot on the refiner's map of recent years, six out of eight samples exceeded 72, L-3, most of them, however, by fractional values. In a Mid-Continent city only four out of eight sample averages showed rating higher than 72, the highest being 72.8, a survey supporting the belief that higher ratings are incidental and not intended. Two of these samples rated only 70.1 and 70.0, L-3.

If this trend in the high-octane number areas continues to include any considerable number of marketers, it is inevitable that most or all refiners must provide the additional facilities necessary to meet the competition. It is to be hoped that no expensive stampede will occur, which will merely cost the refiner excessively without commensurate return on his balance sheet.

Treating and reforming are the most important process improvements which are occupying refiner's minds, judging from the number of such plants which are planned. Of the number of refiners in the east and on the Gulf coasts which have been interviewed or have replied to questions, more than 20 have indicated that existing treating units—mostly for light oils—will be revamped or expanded in capacity or entirely new units will be installed to improve finished product qualities. A half-dozen reforming units are under serious consideration, with half that number definitely decided on, "if octane number trends continue as at present." Obviously the companies will not identify themselves until definite action is taken, and usually not until the units are under construction.

Mention has been made of the Houdry catalytic cracking units in other articles. This process is reputed to be an excellent adjunct to thermal cracking operations, since, again reputedly, the residuum from this operation is usable in thermal units to further increase total yields of motor fuel. The units now under construction or planned will doubtless be built in several parts of the country, with a preponderant number in the east and midwest.

One east coast refiner plans to spend some $3,000,000 on auxiliary equipment involving the treating and stabilizing of chiefly light products, and to add primary distillation and cracking equipment on that coast and elsewhere, provided additional funds are raised by stock and/or bond issues to be voted on and offered this fall. The money will be spent, much of it, this winter and next spring.

Following up more explicit construction projects, under way and announced, Carbide and Carbon Chemicals Corp. is building a $2,500,000 chemical plant at Texas City for the synthesis of commercial products from cracked refinery gases. This plant will eventually cost $4,000,000 it is understood and doubtless will operate on gases from the large Pan-American refinery nearby, or on other gases from any of several large plants in that region where piping the gases to the chemical plant will be a simple and inexpensive matter if desirable.

Pure Oil Co. is completing a reported 23,000-barrel combination unit by Lummus at Nederland, between Beaumont and Port Arthur, Texas. Shell Petroleum Corp. is approaching completion of a recovery plant, stabilizing equipment and catalytic polymerization unit with hydrogenation facilities, it is believed, at Norco, La.

A 40 to 50 million cubic-foot natural gasoline plant is planned by Hamman Exploration Co. for Bay City, south Texas, one of several plans to better utilize the south Texas field gas for natural gasoline recovery and possibly for polymerizer charge stock. The Kellogg refrigeration process

for natural gasoline recovery and polymerization charge stock recovery, recently started in operation near Duval, Texas, offers a new and interesting method for both purposes which may find considerable application. Another plant in Nueces county, south Texas, is planned by a group reported to be headed by J. J. Sherrin, former president of Shamrock Oil & Gas Co., and Clyde Alexander, formerly of Phillips Petroleum Co. This plant will also handle 40 to 50 million cubic feet of gas and will return stripped gas to the producing horizons.

Five gasoline plants are scheduled for the north Texas area, at least one of which, Continental's in the KMA field, is already operating.

Standard Oil Co. of Louisiana is building a catalytic polymerization and hydrogenation unit at its refinery at Baton Rouge. Southport Petroleum Corp. is reported considering a skimming-cracking plant near New Orleans.

Arkansas Fuel Oil Co. is said to be approaching decision on the installation of combination skimming-cracking-polymerization units at Shreveport. Green Bayou Refining Corp. is planning a 1000-barrel skimming plant on the Houston Ship Channel, reliable reports say. Ashland Refining Co. is completing a 7000-barrel distillation unit at Catlettsburg, Ky., which will be operating by November. Additional facilities will be added to cracking and other plant equipment there within the near future, according to plans.

Allied Oil Co. of Illinois is near completion of a 3500-barrel topping plant at St. Elmo, Ill., to operate on Illinois crudes. Sinclair Refining Co. is building considerable tankage, and a 750,000-cubic foot gas holder at East Chicago. Very few gas holders have been built in refineries and this field offers some possibilities, in view of the ramifications of polymerization, hydrogenation and the greater utilization of refinery gases. Reconditioning of the old Wirt Franklin refinery at Ardmore, Okla. will probably start in the near future.

In the Mountain area and in Canada, a number of plants are planned, with some already building. Dakota Refining Co. plans a small, $300,000 plant for Minot, N. Dak., although report of final decision has not been received. Another plant, of 4000 barrels, is projected for Williston, N. Dak., by producing interests in the Rocky Mountain area, without having reached final decision so far as known at present. Inland Empire Refining Co. will start a 2500-barrel plant at Spokane, Wash., in November, it is reported.

Producers Refining Co., headed by local producing men, plans a 2000-barrel refinery for northern Montana, to cost $650,000, we are told. A number of small plants, mostly skimming units, have been discussed by producers in the Mountain district recently; their fate, however, in most cases is expected to be that of the numerous East Texas plants of a few years ago, or else they will die a-borning.

These western plants are the result of Canada's increase in Turner Valley production, which has gone to supply western Canadian refineries, stopping the export of Montana-Wyoming crude to Canada. A companion result is the building or planning of various refineries by Canadian interests in Alberta or nearby, to utilize local crude at lower overall cost.

British-American Oil Co. started construction on a reported 4500-barrel, $1,300,000 refinery at Calgary, Alberta, to operate on Turner Valley crude, to supply their markets in western Canada. McColl-Frontenac Oil Co., now controlled by The Texas Co., is reported to be making extensive investigations looking toward building two plants, one at Regina, Sask., and one at Calgary, the latter a 2000-barrel unit.

Several areas in this country offer possibilities for further development of refining and natural gasoline facilities, provided, of course, that market demand and market prices warrant. In most cases neither situation offers attractive conditions at present, except in special cases where the individual company has good production or can substitute new facilities and their products for older less efficient plant capacity elsewhere in a less advantageous condition.

It should be a principle of refinery building that any additions to crude processing capacity should be balanced by eliminating an equivalent capacity of obsolescent equipment, less the increase in demand for products over a given period. Failure to maintain this balance has caused much of the unprofitable prices of the last several years. Failure to maintain it in future will continue and aggravate the condition of below-cost prices, overfull storage tanks, overproduction of crude and the drilling of wells which have no shred of economic reason for being.

Union Oil Company Promotes Two

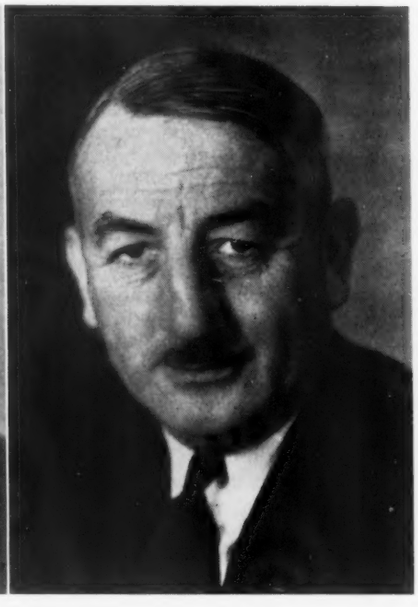
Left—

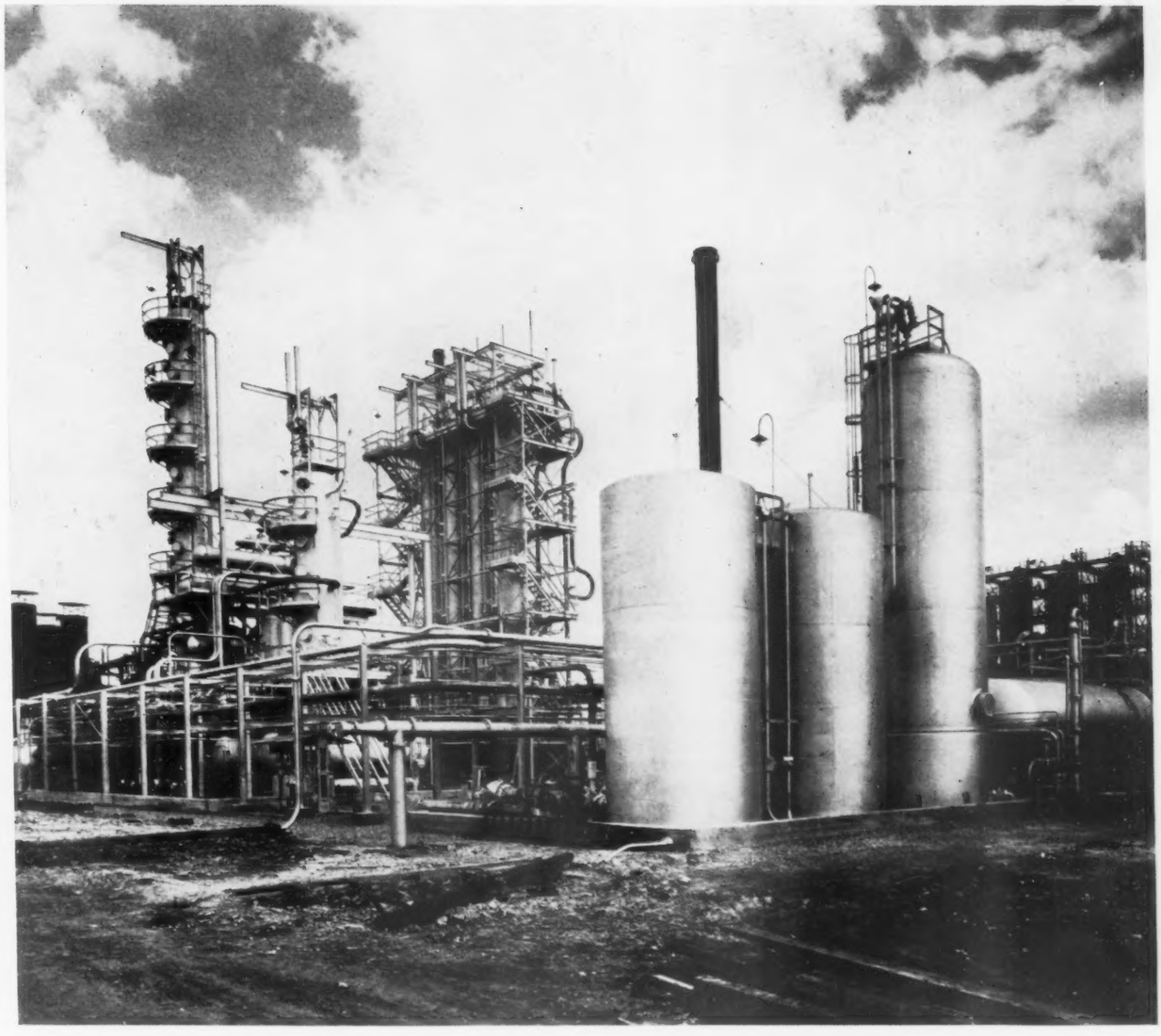
Norval F. Myers was recently appointed manager of refineries for Union Oil Co. of California, by L. G. Metcalf, who a short time ago was appointed to succeed the late R. E. Haylett as director of manufacturing for that company. Myers was formerly manager of the Oleum refinery for Union.

Myers is a graduate of Beloit College and Princeton University, coming to Union in 1925 as research chemist at Wilmington.

Right—

J. N. Holden, former superintendent of maintenance at Union Oil Co. of California's Oleum refinery, has been promoted to manager of that plant, as the first act of Norval F. Myers, new manager of refineries. Graduating from University of California with a master's degree in mechanical engineering, he rose to be chief engineer with Redwood Mfg. Co., and was appointed refinery engineer by Union Oil Co. in 1920.





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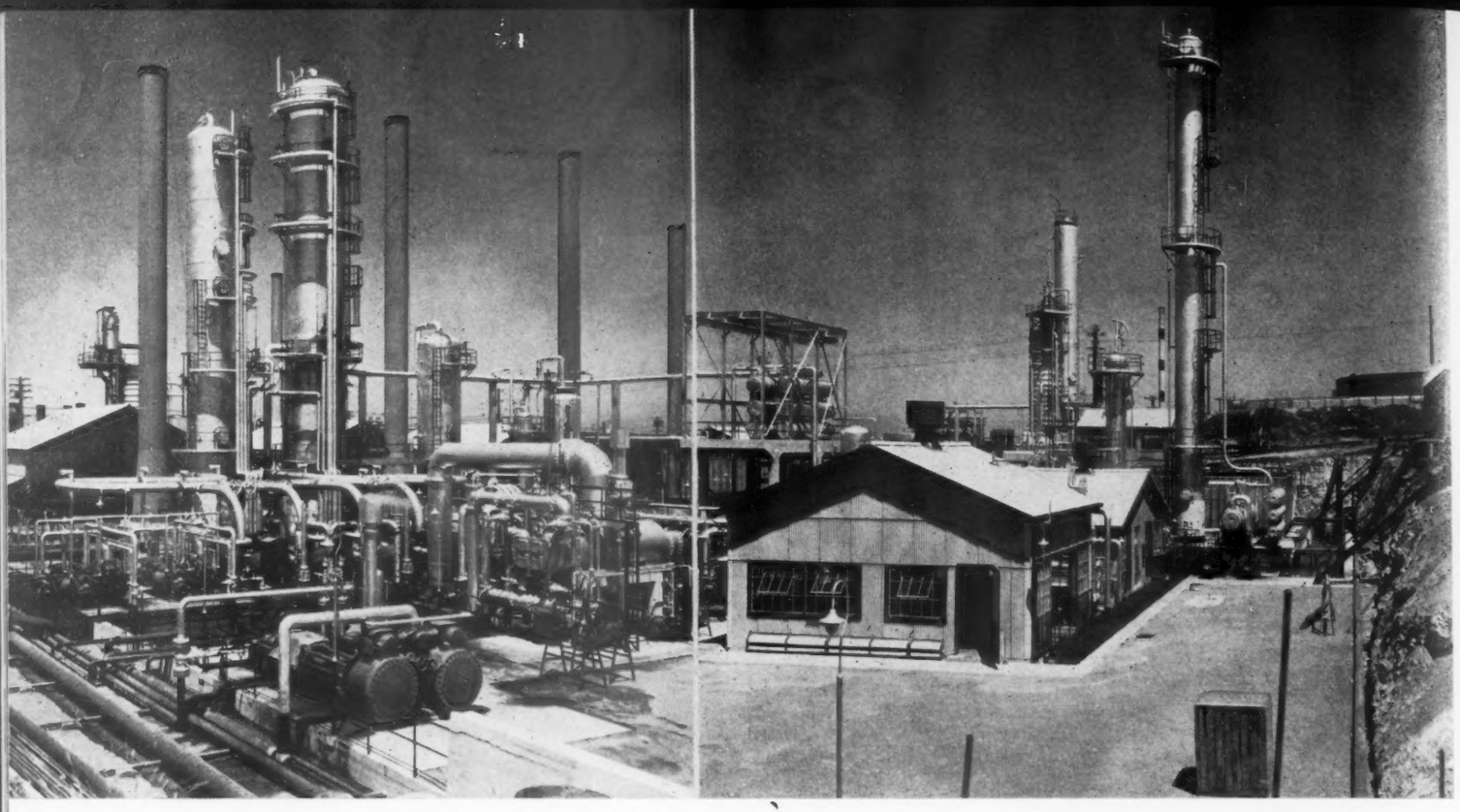


Richfield's new $5,000,000 refinery at Watson, Cal., is typical of the best design in new plant construction. Here pipe lines, heat exchangers, pumps and stills are arranged in the most orderly and efficient manner to simplify both construction and operation and to reduce the cost of both

California Building Trends Toward Using Heavier Oils

By Jack Westsmith

N. P. N. Staff Writer

CALIFORNIA today is looming as an important center for refinery expansion and modernization over the next twelve months, notwithstanding expenditures totalling nearly $20,000,000 for new plants and additions to facilities by oil companies in this territory during the past year.

Noncommittal as to actual details of construction programs being considered for the near future, refinery heads, however, are willing to talk in terms of facilities and processes needed and several placed their fingers on probable trends in immediate refinery construction.

One thing stands out definitely. West coast refiners, large and small, are spending more than the usual amount of time on studying processes designed to raise gasoline octane number and particularly with respect to operations permitting economical and efficient handling of heavy and refractory crudes.

The California picture is dominated today by overhanging stocks of non-gasoline-bearing crudes and fuel oil aggregating some 85,000,000 barrels on July 31, or about 75 per cent of all such products stored in the country. Added to this is the contributing factor of increased production of heavy, high-sulfur crudes from fields opened up within the past year—notably at Santa Maria and Wilmington.

The importance of this factor is illustrated by the fact that stocks of fuel oil and heavy crudes totaled only 62,379,641 barrels July 31, 1937, which means that more than 22,000,000 barrels of these products have been added to storage in the past year.

In any review of refinery construction during the past twelve months and that already programmed for the future, it is interesting to note that specific attention is being given to the growing problem offered by the refining of refractory crudes.

While construction yet to be announced will also be directed toward more economical operation of facilities for crude distillation, reforming, treating and stabilizing, the most important development is expected to come in the form of a building program utilizing the advantages of polymerization, catalytic cracking, hydrogenation or other methods for flexible manufacture of high octane gasolines from light or heavy crudes and from waste products.

One refinery executive said extensive studies had been under way for some time on processes designed to cope with the heavy oil problem and, if the processes prove out as indicated, he thought it only a matter of a short time before construction plans would be announced.

It may be said that California refiners are engaged in no "octane race" at the present moment, despite the fact that octane numbers of gasolines sold today are slightly higher on the average than a year ago. However,

there is general realization that facilities must be built to meet the demand for higher octane fuel tomorrow.

A tabulation of octane numbers on gasolines purchased in the Los Angeles area during two months in the summers of 1937 and 1938 are shown in Table 1. It is representative of all gasolines marketed in that territory with the exception of a few "rebrands" etc. The figures were furnished by the California Testing Laboratories.

Octane number has been no particular problem for the California oil industry, largely because of the high anti-knock properties inherent in the crudes available, even in the so-called refractory crudes when properly handled. This has held back, to some extent, construction of cracking or other octane-raising facilities on the west coast, although the trend has been definitely outlined in that direction in recent years, as the limit was reached on anti-knock characteristics possible without additional processing or adding lead.

The foreseen need for higher octane gasolines, particularly for aviation fuel today and subsequently for automobile fuel, and the increased production of low gravity, difficult-to-treat crudes, are combining to dictate greater improvements in refining methods on the west coast—probably more so than ever before.

Instances can be cited where no important additions to manufacturing plants have been made in more than ten years, and, while wholesale junking of existing equipment is not indicated, it is acknowledged that large-scale revamping and modernization will be needed at these plants in the near future. It should not be gathered from this that all refinery equipment on the California coast is obsolete or inadequate for present and for some future needs. In fact, much of the equipment can be considered the equal of any in the country and in some cases superior.

WITHIN the past year several noteworthy contributions have been made to these facilities, contributions representing definite steps in the direction of solving the acute problem of refractory crude refining and higher octane gasoline production at lower costs.

Standard Oil Co. of California, completing the first hydrogenation plant on the Pacific Coast Jan. 1, has indicated one phase of future refinery construction. Costing approximately $2,000,000, the unit is used in connection with a polymer plant, previously constructed, to yield 100 octane aviation fuel. The plant, located at Richmond on San Francisco Bay, is definitely high pressure—about 3500 pounds per square inch—and is designed for hydrogenation of other products.

Additional lubricating oil facilities, to cost about $2,700,000, were completed early in August and include a 3500-barrel capacity Duo-Sol unit and a MEK-benzol dewaxing plant designed to yield a finished oil production of approximately 1000 barrels daily.

At the present time, this company has under construction at Richmond a new 18,000-barrel crude unit, to cost approximately $825,000 and so constructed that it will permit joint operation with a twin unit being contemplated for the future.

Other capital expenditures at Richmond for revamping and increasing capacities of cracking units, distillation. treating and other additions to manufacturing equipment during the year, amounted to about $900,000. It is indicated that over $655,000 will be spent for future improvements at this plant during the last half of 1938.

Large-scale additions and modernization at Standard's El Segundo plant in the Los Angeles Basin are partly under way or planned. Approximately $200,000 was spent here during the past year for increasing the capacity of refining equipment and it is indicated approximately $750,000 will be approved for other additions between now and the year-end.

Another important construction program recently completed in the San Francisco area is Union Oil Co.'s development at Oleum. Adding to previous construction, which included a $1,500,000 vacuum distillation unit and a propane dewaxing and deasphalting plant put in operation two years ago, is a $2,500,000 expansion program completed several months ago.

This improvement includes a $500,000 crude distillation unit and a $2,000,000 cracking plant. Final tests are now being made on the latter and results are expected to show the application of a specially designed process to the refining of heavy and recalcitrant charging stocks.

The new crude unit is designed to handle 15,000 barrels daily of either high or low gravity raw material and will replace existing equipment now running about 10,000 barrels daily.

Also just completed and undergoing test runs is the $2,000,000 addition to facilities of Tide Water Associated Oil Co., Associated Division, at Avon, on San Francisco Bay. This installation includes new cracking equipment and a 5,000,000-cubic foot capacity polymerization plant.

One of the fingers pointing to the size of future refinery building programs for the Los Angeles area is the $5,000,000 being spent by Richfield Oil Corp. for a complete overhauling of manufacturing equipment at its Watson plant.

Scheduled for official completion in October, the plant has already made gasoline and is expected to be in full scale operation before Christmas. In general the construction consists of two 25,000-barrel combination crude and cracking units, of Sinclair design, a U. O. P. catalytic-type polymerization plant with capacity for 6,000,000 cubic feet of gas daily and an 8000-barrel re-run unit.

This plant illustrates the trend toward facilities designed to operate on even the most refractory crudes to produce high quality gasoline at a reduced cost. It is built to use electric power almost exclusively and features many pieces of equipment entirely new to the refining industry. For example, the main charging pumps are driven by two 1000-h. p. totally enclosed motors, cooled by carbon dioxide.

Shell Oil Co. has had under observation for some time a 1000-barrel experimental cracking plant at its Dominguez refinery in the south, where it is understood to be trying out a variety of operating procedures on various types of charging stocks. Indications are a commercial plant will be built on the basis of these studies, when completed.

The Texas Co. of California, long the subject of rumors concerning plant expansion in this area, recently started

Miles of piping and fittings by thousands are required in a plant such as this one of Richfield. Careful design and layout avoid confusion, simplify construction, operation and maintenance

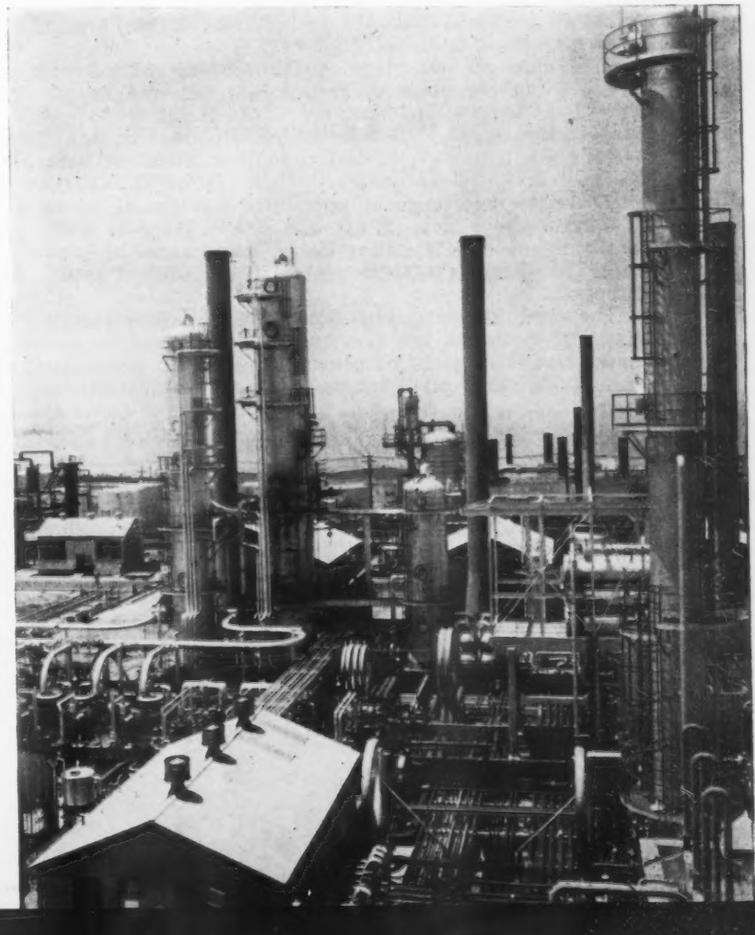


Table 1—Octane Numbers of Gasolines Purchased in the Los Angeles Area in Summers of 1938 and 1937.

	1937				1938			
	July		August		July		August	
	Brands	Oct. No.	Brands	Oct. No.	Brands	Oct. No.	Brands	Oct. No.
1st Structure ("Ethyl")								
High	11	81	2	82	1	83	1	83
Low	1	76	1	78	4	80	2	79
Average	17	80	17	80	18	81	18	81
2nd Structure ("Regular")								
High	1	72	2	72	10	72	1	73
Low	1	69	1	69	2	70	2	70
Average	17	70	17	71	18	71	18	72
3rd Structure								
High	2	65	1	65	1	65	1	65
Low	2	59	9	62	1	61	3	61
Average	20	62	20	63	21	63	21	63

construction of a Stratford cold treating plant to augment present equipment. Total expenditure will approximate $250,000. Designed to handle 5000 barrels of cracked naphtha a day, the treating unit is expected to show marked savings in the cost of handling all stocks, particularly those produced from refractory crudes. Built by Bechtel-McCone & Parsons, the plant will be completed in September.

Any discussion of California refining practices would be incomplete without mentioning successful efforts of Wilshire Oil Co., leading strictly independent refiner on the west coast, to meet the problem of improving gasoline quality without the addition of lead.

Starting two years ago this company added a two-coil Dubbs cracking plant and a cold acid treating plant. This was followed in short order by a 2,500,000-cubic foot capacity polymerization plant designed to handle a stabilized charge of gas from the cracking unit.

Scheduled to be completed Sept. 15 is a 4000-barrel Dubbs reforming unit, which is being built by Fluor Corp. This addition will increase the charge to the polymerization plant and will permit the elimination of straight-run gasoline now sold by the company in competition with low-octane products and will greatly increase the output of high-octane, non-leaded gasoline.

Success of Wilshire's operations and the need to raise anti-knock properties of their gasolines if they are to remain competitive has prompted other independent refiners in this area to give serious consideration to plant improvement.

Considerable interest has been displayed in recent weeks on the possible application of the small-scale polymerization units to solve this vital problem of the California independent—namely higher octane number at lower costs.

Developments important to the western oil industry have been taking place in Rocky Mountain refining activities. At Pocatello, Idaho, the Idaho Refining Co. put in operation July 1 a 1500-barrel combination crude and cracking plant of T. V. P. design, built at a cost of $400,000.

At latest reports no attempts had been made to develop exact yields from its operations, which are on crude from Montana and Wyoming fields. Two grades of gasoline are being made, a No. 2 furnace oil and several grades of fuel oil.

The same interests, with Emby Kaye in charge of refining developments, are also building a 2200-barrel combination cracking plant of conventional design near Spokane, Wash. This plant, to be known as Inland Empire Refineries, Inc., will represent an expenditure of $550,000. It is to be completed by Dec. 1 and will operate on Montana crude.

It will produce three grades of gasoline, also kerosine, diesel fuel, burning oils and fuel oil. It is anticipated there will be a yield of approximately 60 per cent gasoline and 12 per cent by-products. The remaining residue from the vacuum unit is to be sold as asphaltic products, various grades of asphalt and road oil, according to demand.

Based upon the success of these ventures, there is the likelihood that similar plants will be built in other Rocky Mountain sections, which, with the development to date, will ease the crude stocks situation in Montana fields resulting from the cessation deliveries to Canadian points, following discovery of commercial crude production in Turner Valley, in Canada.

Ultra-Modern Heaters Feature of New Plant

Construction at the new $5,000,000 Richfield Oil Corp. refinery at Watson, Cal., includes two combination crude topping and cracking units, a gasoline treating and finishing plant and a completely new polymerization plant.

Being the largest ever erected on the Pacific coast, the six de Florez heaters to serve the two combination units have attracted widespread attention. These furnaces stand 132 feet high and have a diameter of 30 feet. Cost of the heaters and their auxiliary equipment is approximately $1,000,000.

Each of the combination units has a battery of four heaters, three of the de Florez vertical tube down-fired type and one of the Alcorn double-fired horizontal tube type. This group is designed to liberate 300,000,000 heat units an hour.

Capacity of the heaters is 25,000 barrels daily per combination unit. Maximum uniform temperature obtainable in the furnaces is estimated at 1500° F.

Crude oil entering either of the combination units will first be pumped through a system of heat exchangers, where its temperature will be raised by hot streams from the fractionating towers. From the exchangers the oil will pass to the Alcorn heaters.

One side of the heaters will be used for the crude while the other is used for reduced crude returning from the flash towers. Each side of the heater will consist of a radiant heating section surrounded by carbon-steel tubes. Gases from both sides will discharge into a common downdraft convection section, where they will pass around the convection tubes.

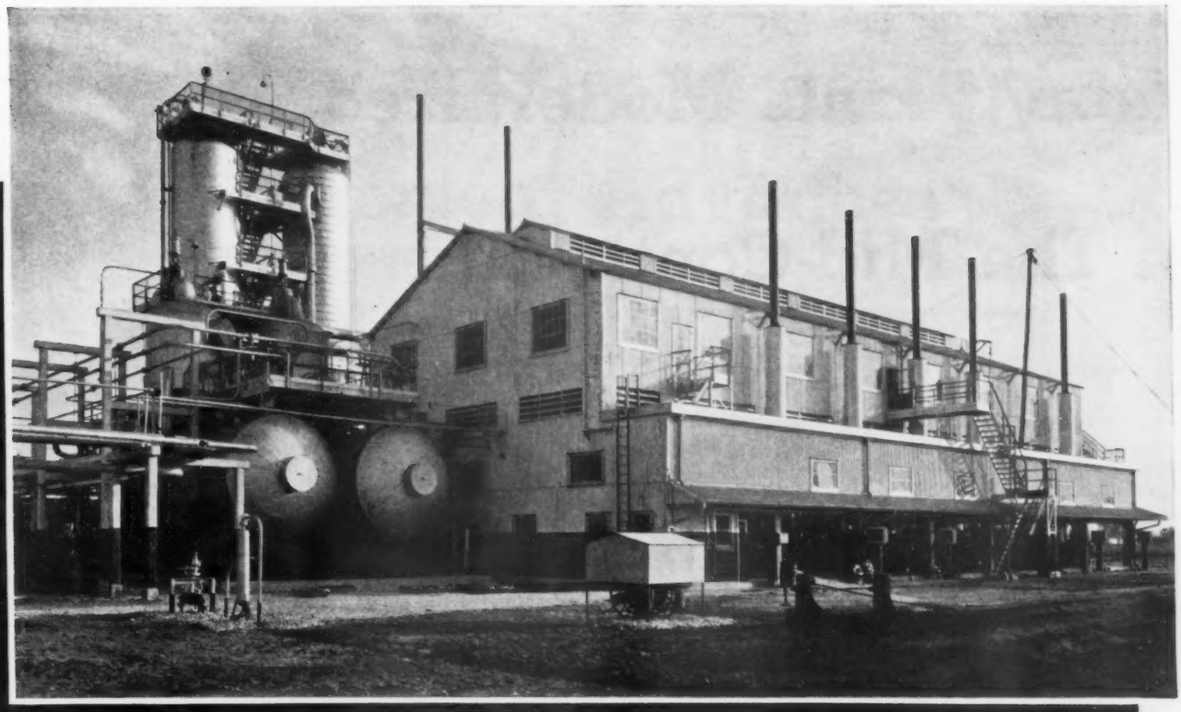
The crudes entering the furnace will pass upward through a bank of convection tubes into the radiant tubes. The heat transmitted to the crude in the furnace will vary from 3,500,000 to 20,000,000 b.t.u. per hour depending upon the cleanliness of the heat exchangers.

When the heat exchangers become dirty, the furnace fuel consumption will increase, but the outlet temperature will be automatically regulated at 625 degrees. At this temperature the crude will pass to the flash towers, where the straight-run gasoline will be removed.

Reduced crude returns from the flash towers to the furnace and enters the constant-load side through a bank of convection tubes. In this side of the furnace 25,000,000 b.t.u. per hour will be transmitted to the charge and the outlet temperature of the reduced crude will be built up to 670 degrees.

A uniform temperature of about 1000° F. will be maintained in the de Florez heaters to induce cracking. Use of the three large vertical heaters, each containing approximately one and one-half miles of 5-inch alloy tubing will permit practically any recycling ratio which may be desired.

There are seven separating and fractionating towers for each combination unit. The largest of these is roughly 13 feet in diameter and 60 feet high and weighs approximately 270,000 pounds.



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Many Plants Modernized

In The Mid-Continent

THE refining and natural gasoline industries in the southwest and Rocky Mountain areas contemplate the expenditure of $10,000,000 to $11,000,000 in the next six months for new equipment and its installation costs. The refining industry will spend between $7,000,000 and $8,000,000 of that sum.

It is reported that two companies are considering the construction of new refineries in the Rocky Mountain area. It is known that equipment men have been advised of the tentative plans.

The Rocky Mountain area, incidentally, has stepped to the front since the first of this year in the matter of refinery construction. The Continental Oil Co. has revamped its Denver plant by installing a new crude distillation unit which increased the capacity from 2000 to 3000 barrels daily. The cost was reported approximately $400,000. The company also has announced it will construct a crude oil pipeline from the Lance Creek, Wyo., field to the Denver plant.

The Idaho Refining Co.'s plant at Pocatello, with a capacity of approximately 1500 barrels, has been completed and placed in operation. The Inland Empire Refining Co. is progressing with construction plans for its 1500-barrel plant at Spokane, Wash., and the Yale Oil Corp. has completed its 1500-barrel plant at Kalispell, Mont.

In the Mid-Continent area no completely new refineries are reported under consideration, although several companies are understood to be considering improvements. Some six or seven refiners are reported planning new furnaces, or changes in present ones, with at least two understood to be considering the installation of new and complete cracking units. Another refiner had a fairly ambitious program ready and equipment men were working on the bids when he decided to delay the project for the time being and concentrate on production.

One or two refiners also are reported preparing to install new vacuum units, at least one is replacing a fractionating tower and several plants are being overhauled in some manner, ranging from new heat exchangers to minor changes in furnace equipment.

There has not been included in the above contemplated expenditures any of the work which has been completed since the first of the year nor started prior to July 1. Approximately $7,000,000 was expended in the first half of the year in refinery construction work.

Construction has ranged from complete new refineries, the revamping of existing refineries and installation of new cracking units and new furnaces down to new vacuum units and the replacement of smaller items of equipment.

The Barnsdall Refining Co., for example, built a new plant at Corpus Christi, Texas, and revamped its Barnsdall, Okla., plant. The Maritime Oil Co. built a refinery on the Houston ship channel. The Pure Oil Co. revamped completely its Muskogee, Okla., refinery, discarding its former Gyro process, and also did extensive work at its Smith Bluff, Texas, plant. The Panhandle Refining Co., has revamped its Leuders, Texas., plant, while Cosden Oil Corp. has installed a new furnace and Dubbs unit, a stabilizing plant, a new treating system and power plant at its Big Spring refinery. The Paluxy Asphalt Co. at Talco, Texas, has installed a vacuum tower, while the Derby Oil Corp. is just completing construction of its new vacuum unit. The Rodessa Oil & Refining Co. is installing a Forward process at its Shreveport plant, while the Root Refining Co. is installing a new cracking unit at its El Dorado, Ark., refinery. The Southwestern Refining Co. is reported constructing a plant in the vicinity of Lake Charles, La.

While construction work during 1938 will change the refining capacity somewhat in the Rocky mountain and Gulf coast areas, it will make very little change in the Mid-Continent district. The increase in crude runs made possible in some plants likely will be offset by the dropping out of the picture of other small plants which no longer can be operated economically. Shutting down of the Shell Petroleum Corp.'s Arkansas City, Kans., refinery will offset much of the new plant capacity.

A few refiners and equipment men meanwhile have reported that business conditions generally this fall will be the determining factor in what will be done by some oil companies later in the year. An upturn in business conditions will swell the total expenditures for 1938.

The construction in the natural gasoline industry the remainder of the year will depend to a large extent on the development of present and new fields. The Gulf coast apparently will be the most active area, particularly as far as new plants are concerned, but the West Texas area is likely to be a close second, natural gasoline manufacturers indicate.

A considerable amount of construction in the inland Texas, Louisiana, Arkansas, Oklahoma and Kansas districts is expected to be in the nature of expansion of present plants, along with improvements at some of the plants.

There already has been started since the first of the year sufficient construction work at gasoline plants to total slightly over $3,000,000, according to the survey.

The Skelly Oil Co. has spent approximately $200,000 in increasing the size of its plant in the Lucien pool, and revamping its plant at Avant at an additional cost of $40,000. At the Pampa plant the company has spent $45,000 extending lines and installing a high pressure absorber.

The Barnsdall Oil Corp. has completed a plant in Ector county, West Texas, at an estimated cost of $375,000, while Phillips Petroleum Co. and Sunray Oil Corp. are constructing a plant in the new K.M.A. field in North Texas at an estimated cost of $500,000. The George E. Lilly interests are reported spending $250,000 in a new plant in the Long Lake field. Continental Oil Co. is constructing three plants in the K. M. A. field.

The Warren Petroleum Co. has made improvements and additions to its plants at Galva, Kans., Graham, Okla., and Aransas Pass, Texas.

The Shell Petroleum Corp. has announced it will spend $150,000 modernizing its Healdton, Okla., plant. Other companies which have built new plants or improved existing ones include: Cimmeron Gasoline Corp., Langston pool near Coyle, Okla.; Tide Water Associated Oil Co., new plant in Anderson county Texas; Humble Oil & Refining Co., new plant in the Flour Bluff, Texas field; Deep Oil Development Co., new plant in K.M.A.; Shamrock Oil & Gas Co., new plant in Hidalgo county, Texas; Del Rey Production Co., new plant at Sandy Point, Texas, and the Portex Oil Corp., a new plant at Logansport, Texas.

New Alloys, Construction Methods Key to Equipment Advances

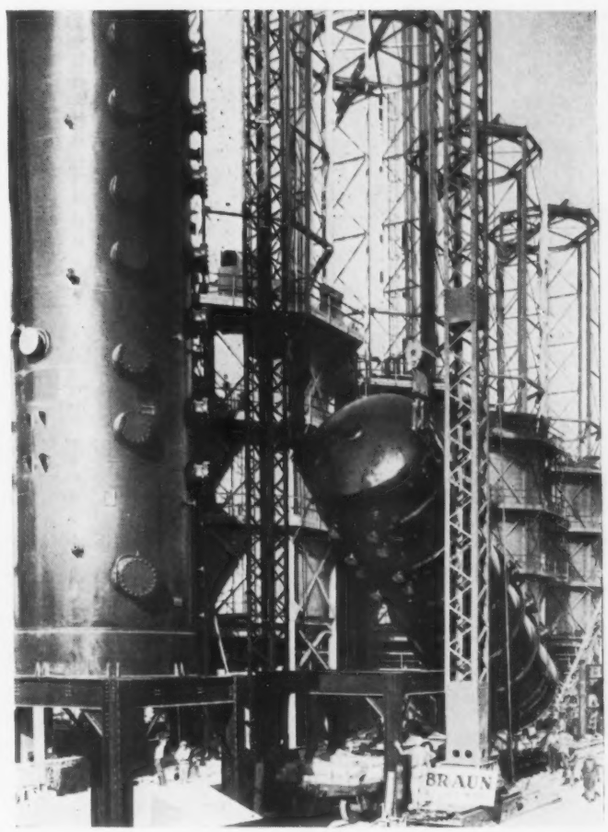
By M. G. Van Voorhis
N. P. N. Staff Writer

A DISCUSSION of recent advances in equipment for petroleum refining is most appropriately introduced by consideration of two factors in addition to mechanical inventive skill which have made this advancement possible. These are the production of suitable alloys and other materials of construction, and the advances in construction methods, particularly welding, which may be considered equally important with the designing engineer's work.

The economic availability of new alloys more capable of withstanding the increasingly high temperatures, higher pressures, corrosive action of materials which must be handled, as well as abrasive and shock treatments which are conditions frequently met in refinery operation, is often the key to advancement in design.

Welding, of course, is not this year's nor last year's advance in metal fabrication. It has been termed often the greatest advance of the past decade but the increasingly greater dependability of the method continues to find for it new possibilities in design. Foundrymen, now thoroughly aroused by the increasing use of plates, tubes, angles and other rolled shapes in fabrication are calling attention to the ability to weld cast steel parts with the resultant advantage of more desirable shape of the finished product. Use of external chills and/or feed heads to secure directional solidification and, as a result, metallurgical soundness, will produce a material that is truly isotropic, it has been pointed out.

The value of welding to refiners has been considerably enhanced by studies to improve welding procedures adapted to special alloys. Lately the lag in welding of copper-base alloys has been reduced by publication of accumulated literature on the subject by a Welding Research committee sponsored by the American Society of Electrical Engineers and American Welding Society.



An early stage in the construction of stills and tower, which shows the method of "ending up" a tower into place, and the permanent scaffolding above the stills

Keep Trying New Alloys

The past three or four years have witnessed a more cautious use of alloys of steel, according to one authority. Lower percentages of alloys have been used and a greater variety to approach the ideal material in tube construction for example. However, the new uses of ferrous alloys in refinery equipment in the past year or so have been quite varied.

There are two stages of acceptance of a given alloy. First, when laboratory tests indicate qualities above those of materials in common use for a given purpose, the material is accepted for trial in service. It may take two or three years under various sets of conditions to determine the economic possibilities of the new material. The second stage is the unconditional acceptance in the light of results of the earlier trials. Among the steels introduced recently, the following have been considered by one authority as having been proven, either extensive in commercial service or after sufficient testing under plant conditions.

Carbon-0.50 molybdenum with 1.50 silicon to replace plain carbon steel for better strength and oxidation resistance up to 1100° F.

2.25 chromium-1.00 molybdenum, for good strength up to 1100-1200° F. where corrosion and oxidation are not severe.

5 chromium-0.50 molybdenum-1.50 silicon, combines excellent oxidation resistance and good resistance to hot oil corrosion.

5 chromium-0.50 molybdenum-titanium, non-hardening steel suitable for field welding, possesses better oxidation resistance than the standard 5 chromium-molybdenum steel.

9 chromium-1.15 molybdenum, semi-stainless steel especially good for corrosion resistance, also shows good creep strength.

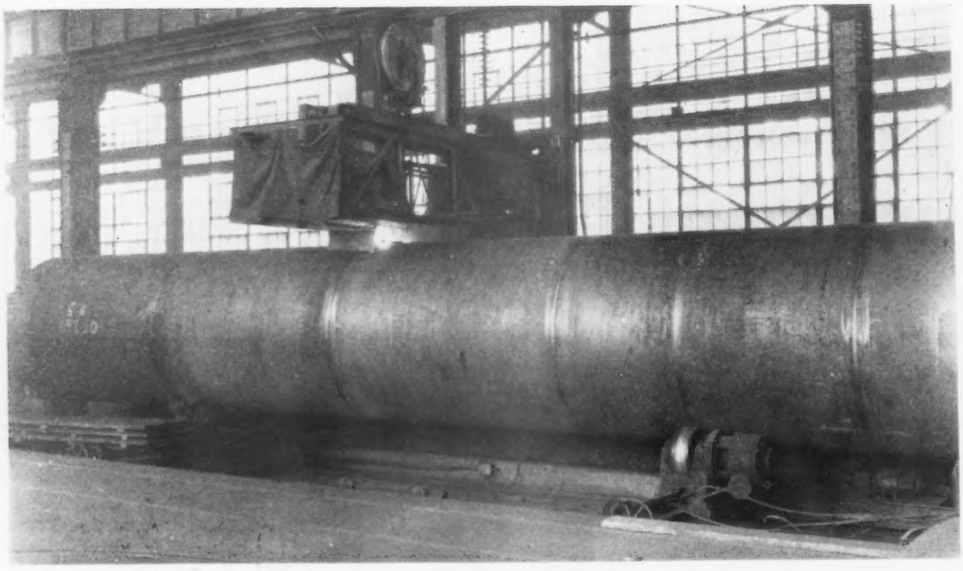
12 chromium-3 tungsten, good strength, corrosion and oxidation resistance for service at high temperatures.

18 chromium-8 nickel-titanium, stabilized austenitic stainless alloy with excellent strength, corrosion and oxidation resistance.

16 chromium-13 nickel-3 molybdenum, adapted from the sulfiate paper industry because it showed better strength and corrosion resistance than regular 18-8 stainless.

25 chromium-20 nickel, austenitic stainless alloy suitable for service requiring extreme oxidation resistance and strength at temperatures up to 1800° F.

In the class of promising alloy steels for which the



Automatic electric welding is now being applied to large cylindrical vessels for oil refining. Riveting is as obsolete as shell stills. Courtesy of Foster-Wheeler Corp.

commercial service data are as yet incomplete, the following have been indicated:

Steels containing 2.50 to 4.50 mean chromium with molybdenum and vanadium, used successfully for several years in the chemical industry, presumably has better strength than the corresponding chromium-molybdenum steels.

Steels containing 3.00 to 5.00 mean chromium with molybdenum, silicon, and aluminum, exhibit better corrosion and oxidation resistance than regular 5 chromium-molybdenum steel.

5 chromium-0.50 molybdenum-columbium, improved non-hardening steel with good impact strength under all conditions of testing.

16-13-3 with columbium, prospective welding grade of the austenitic chromium-nickel-molybdenum stainless alloy.

18-8 with columbium, stabilized stainless alloy suitable for welding without danger of carbide precipitation.

Increasing study of cast iron has resulted in high strength irons that in many instances compare favorably with steel. Many users have concluded from the performance of cast iron products that it is a better material than is indicated by tests of its ductility and tensile strength. In addition to the unexpectedly good performance of cast iron in actual service, the technique of melting, casting, pouring and alloying has been so improved that tensile strength of 40,000 to 60,000 pounds per square inch are common and up to 90,000 or 100,000 pounds per square inch has been produced. Welding difficulty has been studied and it has been found that it is due to failure to cool the weld uniformly or failure to obtain fusion to the bottom of the notch. Some fatigue tests of alloy cast iron in crankshafts revealed they lasted five times as long as steel.

Increasing data on the properties of various alloys and the effect of additions of various quantities of different elements has been of great value in the past year. Among these published data is information on the impact strength of molybdenum steels, for example, which have been made available by the Climax Molybdenum Co. These show the kind of treatment required for best impact properties, that there is no relation between room temperature hardness and other properties, and that inherent grain size has little effect on impact properties. The undesirability of duplex grains in steels subjected to impact loads at low temperatures was also shown.

More and more attention is being given to the development of shorter methods of determining the high-temperature strength of metals, rather than to continue to use the cumbersome and tedious creep-strength test procedure. Creep-strength has been correlated with so-called critical temperatures obtained from short-time tensile strength tests. Tests are made at several temperatures and either a constant rate of elongation or a constant time for rupture is maintained in each of the tests.

Creep strength has not been a thoroughly reliable property, but soon may become dependable, another authority gives assurance. Creep strength data and this method has been severely criticized because of the inconsistency of some data and hence several studies have been devoted to explaining the discrepancies.

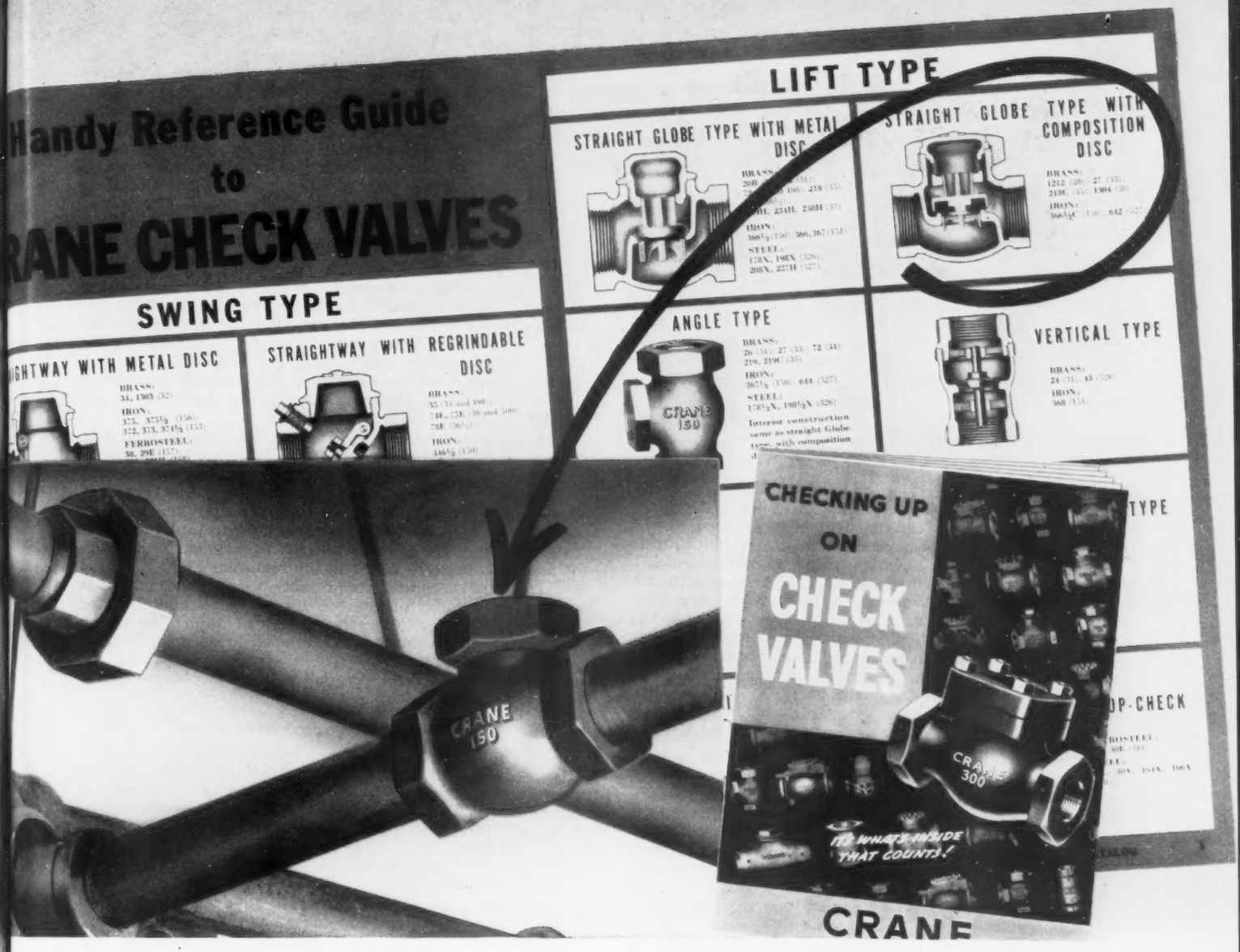
The rapid development of low-temperature processes in petroleum refining has focused attention upon the strength of metals at low temperatures, particularly the impact strength of the materials because the general tendency of metallic material is to become brittle at sub-zero temperatures. Data has shown that impact strength of welds does not decrease greatly at low temperatures and in some cases exhibits even better impact properties.

PROPERTIES of metals suitable for low temperature service have been summarized recently as follows: Solid solution alloys such as monel metal and the austenitic steels such as 18-8 chrome-nickel stainless steel, retain their shock resistance or impact numbers to extremely low temperatures. Alloy steels which contain an element that is soluble in iron are also superior in shock resistance at low temperature. The nickel steels are probably the best cheap materials that are now available. Carbon and the carbide producing elements such as chromium, vanadium, molybdenum, and others are generally unsatisfactory as alloying elements unless in minute quantity, it is said. Steels of high impact resistance will probably come into more frequent use with extension of processes involving extremely low temperature and high pressures.

A new iron-carbon alloy containing a small percentage of nickel combined with boron as a hardening agent is proving to be highly successful for such petroleum services as slush pump liners and oil well pumps. The alloy is extremely hard and resistant to abrasive wear but lacks shock resistance. The alloy is applied to the main body of material by a centrifugal casting process, which results in a surface covering or skin 1/64 to ¼ inch thick. No heat treatment of any sort is necessary to realize the properties.

In handling high corrosive chemicals such as chlorine, hydrochloric acid, alkalies and chlorinated derivatives, the metal tantalum may be important in the successful development of new processes. Tantalum has much the same physical properties as steel and hence it can be fabricated in extremely thin sections except for high pressure. In many equipments the tantalum parts are connected to base-metal parts in such a way that a minimum amount of the expensive tantalum is required. These interesting developments are being shown by Fansteel Metallurgical Corp.

Among the new methods which have offered a solution



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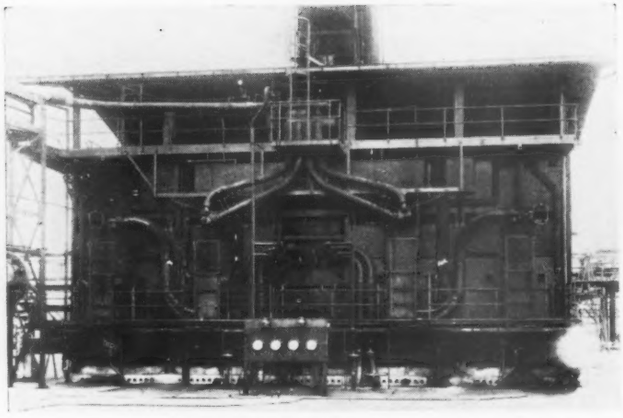


A closeup of a Universal Oil Products Co. down-draft 4-cell Equiflux heater showing interconnecting piping.

to strength and corrosion-resistance problems is the practice of lining a heavy, carbon steel high pressure vessel, such as a reaction chamber, flash chamber, etc., with a thin sheet of a noble alloy, such as nickel, chromium, nickel-chrome or other expensive alloy. This is especially advantageous under corrosive conditions, where a very thick wall is needed for strength. The wall may be several inches thick to give strength without the excessive cost of the alloy throughout, yet corrosion resistance is obtained by use of the alloy sheet in contact with liquid and vapors, the sheet being bonded directly to the plain steel. Another late development is the use of concentric tightly bonded cylinders as a means of increasing the strength of pressure vessels.

Some of the most recent advances in equipment will be on display Dec. 5 to 10 at the National Exposition of Power and Mechanical Engineering in New York. Among the announced exhibits will be a cross-sectionalized working model of a gas pressure regulator to demonstrate automatic control over rising pressure. A new column-type liquid level controller will introduce a method employing air pilot control mechanism. A valve that separates water and solids from steam and compressed air as they flow through a self-contained separating unit inside the valve will be shown in cross-section. Another manufacturer will show compressor valves machined from solid alloy steel forgings.

THE application of centrifugal force during the casting of pipe or tubing is becoming more and more common. Under such conditions such impurities as slag, dirt and gas are spun to the inside of the tube where they can be easily removed by machining. The resulting iron is said to be exceptionally dense and fine grained, and in fact has a fracture similar to the silky fracture of tool steel. According to E. F. Green of the Axelson Mfg. Co., the new supercast pump liners of this company, made by centrifugally casting an electric furnace alloy cast iron, are far superior to the hardened iron liners heretofore available.

More and more attention is being given to special alloys for condenser tubes for corrosive conditions. Copper nickel alloys containing 20-30 per cent nickel have been in service for several years and are superior to brass tubes except in cost. A feature developed in tests at one refinery is that this alloy has the ability to prevent or at least resist deposition of free carbon when in contact with hot oil vapors.

One of the more recent experiments in still tubes is the addition of aluminum to the standard chromium, molybdenum and silicon tube steels. This has been advantageous in improving the resistance to sulfur corrosion and high temperature rusting. Such materials are said to be also less affected by cold work—that is, the rolled ends of tubes do not corrode more rapidly than the rest of the tube, as is frequently the case with regular 4-6 chrome-moly tubes. Timken of Canton, Ohio, introduced the use of aluminum and the composition of one of this company's tube steels includes 0.15 carbon, 0.30 manganese, 1-2 silicon, 4-6 chromium, 0.4-0.6 molybdenum and 0.5-0.9 aluminum.

Five years of use alongside of regular 4-6 chromium molybdenum tubes showed the aluminum bearing alloy to be about twice as resistant to sulfur attack and far more resistant to oxidation or scaling at high temperatures. It was nearly completely stable with regard to grain growth or change in strength if the temperature does not exceed 1490° F.

Design of Pressure Vessels

The problem of pressure vessel design hinges largely upon the qualities of materials available also. In addition, however, considerable information on design from the strength standpoint has been obtained by experience and tests. These particularly concern correctly shaping the vessels and adequately reinforcing the opening. The safe operation of pressure vessels is more nearly assured if attention is paid to designs which bring all parts of the vessel to a balanced load-carrying value.

Important advances in pressure vessels are, therefore, tied to qualities of materials for fabrication. Flaws in materials can be detected by X-ray, which has been a valuable prover for welding in pressure vessel construction. Progress made in recent years in perfecting welding techniques for alloy steels and alloy-clad steel plates offers new opportunities in many process operations for the use of materials better adapted to the requirements.

While advancement in pressure vessels and tubing is largely an account of the proving of better materials of construction and welding, many special appliances or refining accessories have been developed independently from the processes themselves. These are the pumps, for example, and the control equipment. Valves, burners, and furnaces are also leading accessory equipment.

New Alloys in Valves

Newly improved valves were frequently announced during the past year and here again the use of the highest grades of steels and alloys was generally featured. A typical example is the Hancock blow-off valve with "Blo-Deflector" protecting lip and described as almost indestructible. Stainless steel valve discs of 500 Brinell hardness and renewable valve seat rings heavily Stellited contribute to long life in this valve.

Another gate valve, made by The Fairbanks Co., features relief slots permitting drainage back to the body chamber and eliminating the possibility of freezing and clogging above the bonnet threads. Jenkins Bros. introduced a new bronze valve with a one-piece, screw-over bonnet and slip-on disc holder. Gate valves are fitted with a disc holder in which the disc may be quickly replaced by removing the bonnet to get at the disc seat, a composition material. A new design of disc in its iron body valves permits many regrindings since the disc never overhangs the seat and the seat and disc "grind in" evenly.

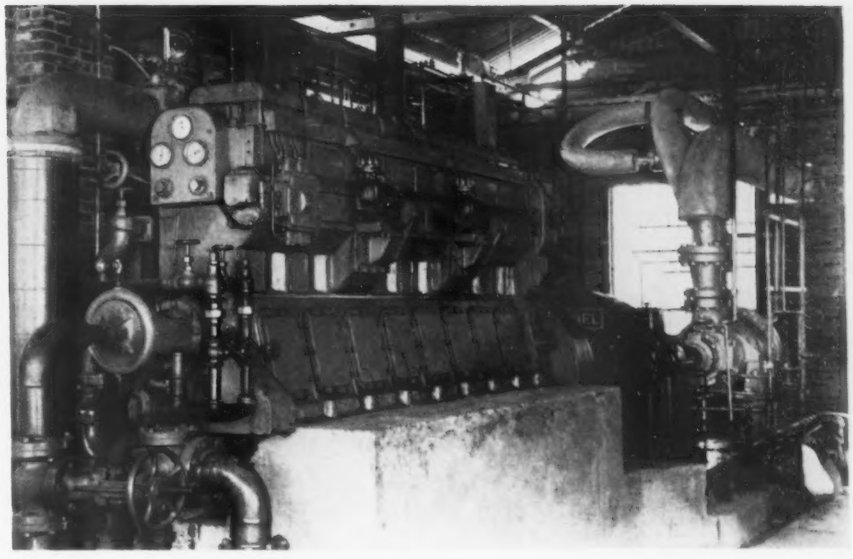
Even valve parts have been made a specialty of Goetze Gasket & Packing Co. Its recently announced all-purpose disc for globe valves features a laminated construction built of alternate layers of asbestos and metal completely encased in a two-piece shell of copper, Monel or other alloy metal.

New Principle Employed

In the division of water treatment or settling of solutions and mixtures, Graver's new Seip multi-tray clarifier is said to introduce a new principle of upward sludge filtration by means of a periphery intake channel. The settler consists of from one to seven, round, inverted trays in a tank shell. The space in each tray forms a settling chamber, on top of which solids from the chamber above collect. Movable scrapers on a central shaft remove surplus sludge.

Continuous recording of alkalinity of dehydrator water from gasoline scrubbing towers has been offered by the Leeds and Northrup Co. Variations can be followed on a dial indicator continuously recording pH values.

The bubble caps in fractionating towers have been made a specialty of Allegheny Steel Co. as a result of the company's ability to produce one-piece seamless design from high-chrome alloy. Numerous sizes are available as well as in other materials. Another market has opened in connection with distillation in the manufacture of carbon



Gas, gasoline, and diesel engines are powering much of the hot oil pump capacity in our present cracking units. This Cooper-Bessemer gas engine coupled to a Byron-Jackson centrifugal hot oil pump is supplying the Cosden cracking unit with recycle charge, at Big Spring, Texas.

Raschig rings. National Carbon Co. has shipped several carloads for one company alone. This company has also announced a carbon tube which may find an application in refining heat exchange uses.

High temperature service is demanded of other materials than the steels used in fabrication of equipment. One of the announcements of the past year was Goodyear's new Flu-Still cleaning hose. Not only must this resist high temperature but the disintegrating action of oil. Synthetic rubber is being used more and more in the petroleum industry because of improved resistance to disintegration.

An interesting development in the field of heat exchangers is a new ribbon counterflow exchanger and cooler brought out by Condenser Service and Engineering Co. This exchanger has narrow, flat streamlined passageways for both liquids, arranged for true, counterflow, heat transfer. It has no gasketed joints which would permit leakage between fluids and all passageways or transfer surfaces are accessible for cleaning. Passageways for one fluid can be opened for cleaning by removing two heads without even shutting off the flow of liquid through the other passages. Performance tests, liquid to liquid, have resulted in securing heat transfer rates of over 500 B.t.u. per square foot per degree F. temperature difference, it is said.

Improved tools should not be overlooked in a survey of equipment advances. A notable addition is an extractor for broken pipe and studs introduced by Reps Tool, Inc. This tool has a four-point grip which prevents reaming and assures a strong bite without hammering or pounding. A built-in reamer automatically removes burrs from the pipe, eliminating interference with the extractor's bite and minimizing cause for expansion of the broken piece. The extractor pulls rather than reams.

Much Ingenuity in Pumps

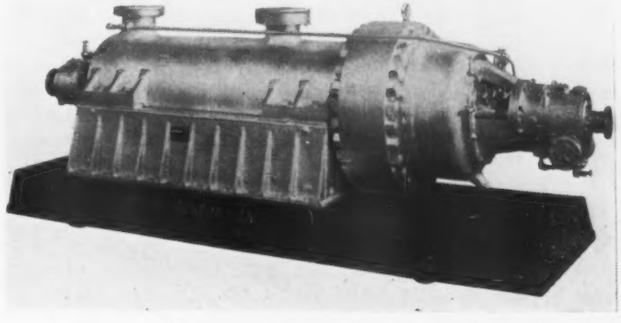
In the important field of pumping, what is believed to be a record in number of stages for a hot oil centrifugal pump has been employed by Byron-Jackson for Atlantic Refining Co.'s new polymerization plant at Philadelphia. This pump's 19 stages build up a pressure of 4000 pounds per square inch and have a throughput of 30,000 barrels per day. The success of centrifugal pumps in this type of service is only a matter of a few years. In pumps for this service the problem of packing glands, especially with very light products, is critical. With heavy oils gland oil may leak into the charge without trouble.

An improved multi-stage pump using double suction impellers and double balance of the rotating element has been introduced by Allis-Chalmers. Double suction provides axial balance and the positions of the successive volute passages which surround each impeller are made so as to largely equalize unbalanced radial forces on the impellers. Horizontally split casings are used for pressures to 1500 pounds and above. Tight joints are maintained by special attention to bolting design.

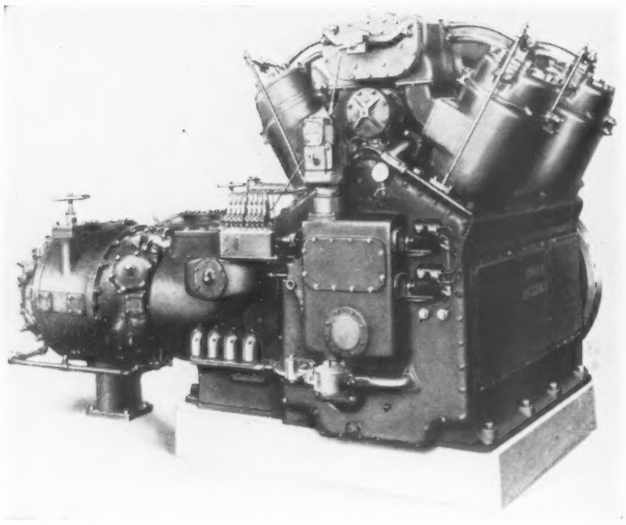
An improved line of single-stage and two-stage horizontal dry vacuum pumps for handling air and vapors not liquefied in the condenser and for pulling a vacuum in any closed system, has been announced by Worthington. Ingersoll-Rand announced a "unique new turbine-driven pump featuring a compact construction that combines both turbine and pump as one unit on a common shaft." It is a single-stage pump for capacities up to 1000 gallons per minute and heads up to 550 feet. It is said to make possible a substantial reduction over ordinary turbine-driven pump weights and sizes.

A recent addition to the Kinney line is a pump for handling acid sludge. Basically its standard rotating plunger pump, modifications have been made in the lubricating system and stuffing box for acid sludge service. Pressure lubrication is applied through three lines. One line supplies oil to a closed head bearing and to the internal working parts of the pump. The second lubricates the open head bearing and the third line seals and lubricates the stuffing box. Installations have been made for handling sulfuric acid sludge in which there has been no leakage and corrosion at the stuffing box, it is said.

Another rotary displacement pump which has come to be quite generally used for handling lubricating oil and fuel oil is the simple De Laval-IMO pump. Three meshing, screw-like rotors do away with valves, reciprocating parts, priming or pilot gears, and all but one stuffing box which is under suction pressure. Since there is no trapping of



The largest high pressure centrifugal pump ever built in this country was built by Byron-Jackson Co. for pumping 900 gallons per minute of propane of specific gravity 0.48 at 130° F. under a suction pressure of 450 pounds gauge. Discharge pressure is 2200 pounds gauge. The pump has been successfully operated for about one year at the Atlantic Refining Co. plant in Philadelphia.



Built to put greater horsepower in a smaller compressor unit, Cooper-Bessemer's new compressor is said to be readily transportable.

liquid and no pulsation or vibration, the company points out the pump may be run at any speed, such as that of standard speed motors and turbines, where the viscosity and vapor tension characteristics of the liquid permit.

Another advance in acid sludge pumps of The LaBour Co. is a safety gland making it possible to tighten the gland without the possibility of the hand coming in contact with liquids which might be escaping through the packing. The pump is self-priming and provision is made for separating vapor and liquid in a built-in separator chamber which takes advantage of a temporary pressure difference between two passageways between the pump and chamber to obtain the priming liquid while disposing of entrained vapor.

Another kind of a pump is the compressor. Meeting a demand for greater horsepower in smaller compressor units, Cooper-Bessemer recently announced a two-cycle, gas-engine-driven compressor combining V-type power cylinders set vertically and compressor cylinders arranged horizontally. It is rated 100 h.p. per cylinder at 300 r.p.m.

A new feature of Westco turbine pumps is their removable liners which cut down the metal required for alloy construction. The liners form the liquid channel so that it becomes seldom, if ever, necessary to replace the more expensive casings. The removable liners also enable the capacity and head to be varied by using different size sets of liners and impellers. Pumps of this type are single-stage, double-suction type with vertically split casing. Pressures up to 350-foot head of water for 110 gallons per minute and 420 gallons per minute at 10-foot head are available.

Pump design, like other equipment requires a careful selection of materials to resist abrasion and corrosion, and to have sufficient strength. In reciprocating pumps handling hot oil above 600° F. and at pressures over 400 pounds per square inch, the liquid end should be of forged steel, according to one authority. The valves, seats, and other parts are usually of 12-14% chromium. Addition protection at the liquid end may be obtained by using 4-6 chromium and 0.5 molybdenum.

Automatic Control Centralized

An outstanding trend in the automatic control of modern petroleum refineries in the past two years is the increasing use of pneumatic type instruments. Largely responsible for this trend has been the demand for the advantages of more centralized control which pneumatic systems are said to be best qualified to handle because of their dependable positive action as well as safety.

Development of equipment to operate by means of compressed air or gas has been in progress in the plants of all leading manufacturers of control equipment. Brown Instrument Co. came out with a complete line of pneumatic control instruments for the refinery with its Air-O-Line instruments four years ago.

While no two pneumatic systems operate exactly alike, the use of a flapper or vane over an air discharge nozzle with some kind of automatic adjusting means is employed by all. Considerable mechanical ingenuity has been exhibited in applying the system to the various types of control, such as the potentiometer indicating or recording controller, for example, which is an electrical instrument for temperature control with the thermocouple. Even the Leeds and Northrup Co. has added recently a mechanism to its well known potentiometer making it directly adaptable to any pneumatic system, although the company was not the first to add devices for this purpose to its instrument. It involves the use of the slide-wire adjustment motor for setting in motion the mechanism which controls the pressure in the air lines.

In pressure controllers the winding and unwinding of the coiled tube is commonly the motivating power for the air pressure control. The last step in the trend toward complete centralization of control instruments is made possible by pneumatic intermediate transmission between points of measurement which are considerable distances from the central control room. Its use is particularly adaptable to flow measurement but not limited to this alone. The general lack of necessity for reading liquid levels in a central control room has made it unnecessary to employ any kind of transmission to a control room, it is said.

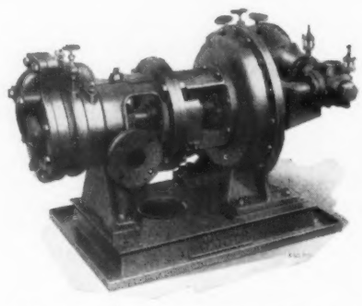
Another trend is to consider the design of control systems with the design of the refining process rather than leaving it as an afterthought to be attached to the process as designed. Such a procedure has given control equipment engineers greater opportunity for providing most efficient process control, it is said.

Higher Heating Rates

In most refining processes, and particularly in cracking processes, the heater is the most important and usually the most expensive single piece of equipment and often determines whether the refining unit can be modified to meet new operating conditions. The tendency of recent years is toward increased flexibility of operation and also increasingly high temperatures and higher oil velocities through the tubes as well as increased rates of heat input.

New designs of one builder are incorporating the principle of subjecting oil to very high initial heat rates, and progressively decreasing these rates as the oil is cracked. Various methods are being used to accomplish this result, one of the most important being the use of separately fired radiant soaking sections. The importance of definite control of the oil heating curve as a means of eliminating coking in the heater, and obtaining the products desired, is being realized more and more.

Very much higher rates of heat input are being realized by a new type of furnace (Equiflux of Universal Oil Products Co.) which imparts heat nearly equally on both sides of the tubes by positioning the tube banks at the center rather than along the walls, ceiling, or floor. This design is said to make the heater suitable for any type of cracking stock up to and including cracked residues



A substantial reduction in size of turbine-driven pumps resulted from Ingersoll-Rand's design of pump which features a common shaft for turbine and pump.

where the shortest possible coil is desirable. Both up-shot and down-shot fired units have been built but the latest design employs down-shot firing exclusively. Various types of heating are provided for a given process by provision of several units built side-by-side in which the arrangement of tubes and combustion of fuel may be varied to suit the conditions.

Recent improvement in heat generation and distribution and better understanding of the laws of radiant and convection heat transfer, have contributed to the development of the present-day, open-flame heaters and their almost universal adoption. The proportion of radiant heat input has been gradually increased from 25 per cent of the total in the early heaters to as high as 80 per cent of the total in the latest designs.

Since modern heaters supply from 60 to 80 per cent of the total absorbed heat by radiation, their operation is determined primarily by the rates of radiant heat transfer that can be obtained and safely applied to the oil. Consistently long runs with heat transfer rates of 20,000 B.t.u. per hour per square foot of internal tube surface for the radiant heat absorbing banks are not uncommon, even when processing residual oils at temperatures over 950° F., it is said.

A properly designed heater must have a relationship of heat transfer rates and heat requirements that will produce a heating curve corresponding to the time-temperature effect most suitable for the service intended. Design of heaters to meet specific time-temperature relationships is a comparatively recent development and the data for such design are not as yet freely interchanged or disclosed.

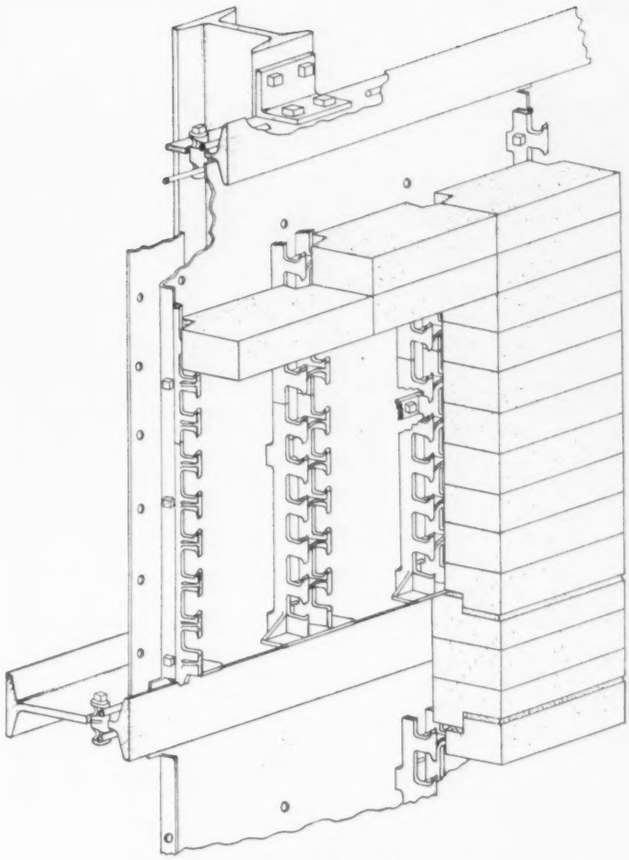
NEW type of heater recently put into service by The Lummus Co. permits control of the heating curve by using independently fired heating and soaking sections. Uniform heat transfer rates are attained by a proper correlation between flow of oil through the tubes, flow of combustion products from the heating chamber and disposition of the tube surfaces. This is accomplished by removing products of combustion over the entire roof area and controlling velocity over the surface of the upper radiant tubes.

In a heater of this type the upper-row roof tubes, which ordinarily have a considerably lower heat transfer rate than lower roof tubes, are covered by a special baffle tile which give restricted clearance between the tube and tile so that a high gas velocity over the surface tubes is obtained. Uniformity of heat transfer in radiant sections is obtained by firing from both ends of the heater parallel to the tubes.

Flexibility of operation is stressed in the latest Alcorn Combustion Co. furnace. The Alcorn heater is a double end heater with a single or double row of tubes located around each radiant chamber. The utmost flexibility is said to be offered and by proper operation a means is provided for obtaining the highest crack per pass for any given stock being charged to a single heater. In one plant as many as eight changes in type of stock have been made during a single run without having to curtail the length of run because of change in the quality of stock going to the heater. One of the design features is the sloping roof to provide greater radiant heat for the roof tubes from the muffles, bridge wall, and the non-luminous products of combustion. The sloping of the roof was also said to assure a very even input across the width of each individual bank.

While great progress has been made in improving furnace design there is still room for vast improvement. M. W. Kellogg Co. engineers point out that the increased use of a method of tube cleaning which permits the elimination of the slow, old-fashioned method using tube cleaners, will probably lead to markedly differing types of furnace design in the future.

Wall construction at the present time is almost entirely of the suspended type in which refractory brick are held singly or in units of several brick by cast iron and steel framework. The refractories are generally backed by insulation with careful provision for prevention of excessive temperatures in the steel or iron structural frame. At the present time light-weight insulating refractories are being increasingly used as tests and experience show economy of this type of construction. Furnaces of this



4½" Insulated Tile Panel Wall

Suspending framework for furnace walls built with insulating refractory brick may be considerably lighter than that for refractories more commonly used. George P. Reintjes Co. has developed this design for wall construction.

type have been recommended by The Lummus Co. as important in elimination of settling of foundation as well as for the insulation value and low heat storage which reduces coking of tubes after a shutdown.

Requirements of the burners used in cracking furnaces or heaters have now become well defined. A number of types are available to the refiner with varying characteristics for burning gas or liquid fuels or both. The combination burners are of four basic types—the premix, semi-premix, throat mix, and furnace mix. Of these the throat mix type is said to be most commonly used.

While there is possibly not so much importantly new in fractionating towers, there is evidence of improvements along that line which can make a record run of over 22 months of continuous operation. Such a record was reported by Foster Wheeler Corp. last April for a two-stage, atmospheric and high vacuum distillation unit operated by the Mid-Continent Petroleum Corp.

A record of this kind involves such superficially insignificant incidents as a gasket failure in the piping, a leak in the shell-and-tube heat exchanger, condenser or cooler, loosening of a furnace header connection, or a header plug, or the packing of a pump. The record, therefore, speaks well of all these items and others which have been made stronger links in the chain which holds the process to its task. An operating kink here and an apparently negligible change in design there have cut operating costs, maintained efficiency by preventing the fouling of furnace tubes, bubble trays, heat exchangers, pipe-lines and connections with asphaltic residue and other substances.

One of the features of this plant is the entirely closed system of liquid reflux that is circulated over a bank of specially designed bubble trays in the vacuum tower to maintain the desired top tower temperature. The equipment is arranged to avoid the usual carry-over and loss of oil to the barometric condenser.

"State of the Art"

AS SEEN IN THE WORLD'S CURRENT TECHNICAL LITERATURE

Papers presented by the Division of Petroleum Chemistry of the American Chemical Society Sept. 5-9, in Milwaukee and here reviewed include a detailed economic discussion of trends in gasoline substitutes in Europe, including the now declining consumption of power alcohol, motor fuel production from coal, oil shale and wood, as well as the use of compressed gas and vehicles making their own gas en route from wood and charcoal.

High Octane Fuel Production

High octane fuels are produced by use of sulfuric acid with olefins added to isoparaffins. S. F. Birch, A. E. Dunstan, F. A. Fidler, F. B. Pim, and T. Tait, Anglo-Iranian Oil Co.

The production of high octane isoparaffinic fuels by the addition of olefins to isoparaffins has been accomlished recently by using concentrated sulfuric acid. Two other methods, one employing boron trifluoride activated by means of nickel powder and water or hydrogen fluoride (Ipatieff and v. Grosse) and the other employing heat and pressure alone (Frey and Hepp) have already been developed.

The new manner of producing the reaction, which has so far been confined to the lower isoparaffins, was found to be general so far as olefines were concerned. Whether effected with the aid of halide catalysts, heat and pressure alone or sulfuric acid, the direct addition of olefin to paraffin is accompanied by secondary reactions which invariably result in complex final products boiling over a wide range. The primary reaction may result in the formation of more than one isomer depending on the manner in which addition takes place.

Isomerization plays an important part in the reaction particularly when aluminum halides or sulfuric acid are employed. Another type of reaction occurring when the olefin paraffin addition is effected by halide catalysts involves degradation of some or all of the primary products. Products of this degradation are isoparaffinic and are formed by processes involving isomerization and recombination.

Reactions of a similar nature also take place when sulfuric acid is employed. Since, however, the acid is less drastic in its action than the more vigorous halides, it is doubtful to what extent any but the more reactive complex isoparaffins are affected.

An earlier account of the process involving pure hydrocarbons showed that the reaction may be applied generally to the lower olefins with the exception of ethylene. Good yields of saturated products boiling between 80-365° F. and possessing octane numbers over 90 have been produced. Of the paraffins investigated, isobutane, isopentone and isohexane (2—methylpentane) reacted smoothly although the octane number of the saturated product fell off rapidly with increasing length of the carbon chain of the isoparaffin used.

The reaction is conveniently carried out in the liquid phase by adding the olefin over a definite period of time to the vigorously agitated isoparaffin and acid. Conditions favorable for fine acid-isoparaffin emulsion formation are essential, i.e. a high acid-to-hydrocarbon ratio, to prevent polymerization. Since the most convenient temperature range for the reaction is between 14-86° F., except when working with isobutane, the reaction may be carried out without pressure. The reaction is, however, exothermic and means must be provided to remove the heat evolved.

From the physical properties of the products it appears that irrespective of olefin and isoparaffin involved, the hydrocarbons formed consist substantially, if not entirely, of isoparaffins. The variation of octane number with boiling range of the gasoline fraction is tabulated below. The fractions are from the di-isobutene-isobutane reaction products (olefin to paraffin ratio is ½).

Fraction Boiling Range °F.	Octane Number
122-149	92.2
149-194	89.7
194-208	93.4
208-221	97.5
221-239	90.0
239-248	92.7
248-257	92.2
257-266	89.3
266-293	79.7
293-306	85.2
306-329	83.5
329-338	85.1
338-347	85.6
347-365	86.6
365-374	87.3

The most favorable concentration of acid for the reaction is 96-97% by weight (101% for propylene-isobutane reaction). Higher concentrations generally result in sulfur dioxide formation and charring and fouling of the acid. Optimum temperature is 68° F. The ratio of reactants is probably the most important factor in determining the composition and characteristics of the product. In general the presence of such diluents as normal paraffins does not seriously affect the course of the reaction, particularly when the isoparaffin is in excess of equimolecular.

Substitution of normal butenes, either butene-1 or butene-2 for isobutene in the reaction with isobutane was found to be without effect upon the boiling range or octane number of the gasoline produced. If, instead of the simple C_4 olefins, the lower isobutene polymers, such as the di- and tri-merides, or the butene-isobutene co-polymer are allowed to react with isobutane, addition proceeds smoothly and products are obtained identical with those formed from the olefins from which the polymers were derived. The gasolines from these reactions are fully saturated and have an octane number over 90.

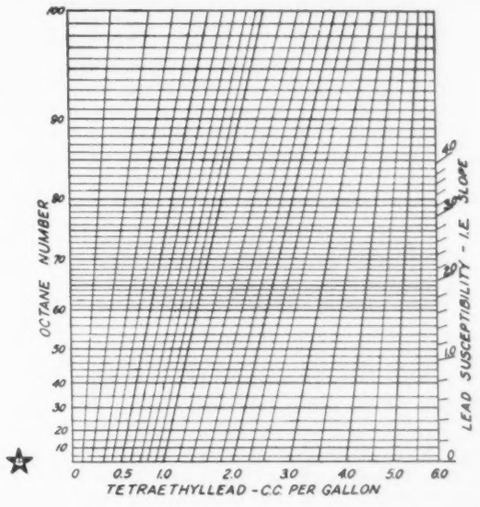
Mixtures of olefins are equally satisfactory. Thus the crude polymer from the so-called cold acid polymerization of isobutene proved to be entirely satisfactory as a source of olefin. Using the C_4 cut obtained from cracking gases also proved to give satisfactory results in spite of the presence of 3.6% butadiene which is normally polymerized easily by concentrated sulfuric acid. Blended with 25% of a special Iranian gasoline cut with an octane number of 70, together with 2.17 cc. of tetraethyl lead per U. S. gallon, these gasolines provide a satisfactory 100 octane aviation gasoline.

An acid consumption of 31.9% was obtained. This is based upon small scale batch operated process but was found to agree with results obtained from a small pilot plant in continuous operation. 1600 cc. of 97% acid was employed to treat eight successive batches of technical diisobutene and isobutane, the total amount of useful product based upon the weight of the acid used was 314R and upon the olefin 152%. This corresponds with the acid consumption of 31.9%, the used acid having a concentration of approximately 82%.

TEL Susceptibility Chart

Chart expresses tetraethyl lead susceptibility as single figure. L. E. Hebl, T. B. Rendel, and F. L. Garton, Shell Petroleum Corp., Wood River, Ill.

The "lead susceptibility" of a gasoline may be expressed as a single figure by employing a new chart constructed in such manner that a linear interpolation is obtained between A. S. T. M.-C. F. R. motor method octane



numbers and tetraethyllead concentrations in any base gasoline.

Five factors have been shown* to affect octane number of an ethylized gasoline effectiveness of different concentrations of *iso*octane, effectiveness of different concentrations of tetraethyllead, octane number of the base gasoline, lead susceptibility of the gasoline, and concentration of tetraethyllead. These factors are incorporated in the Ethyl Blending Chart shown herewith.

*Ind. Eng. Chem., Feb. 1933, p. 187.

* * *

Caustic Soda Cuts TEL Needs

Caustic soda wash is needed with "Doctor Treatment" to cut tetraethyl lead requirement for high octane number. L. M. Henderson, W. B. Ross, and C. M. Ridgway, The Pure Oil Co.

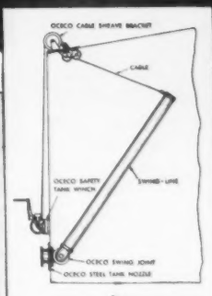
Gasolines, when treated with sodium plumbite and sulfur, require more TEL (tetraethyl lead) to produce a given octane value than do those treated with caustic soda alone and more than do those which have been thoroughly scrubbed with caustic and subsequently treated with sodium plumbite and sulfur. Experimental evidence shows also that the differences in quantity of TEL required are related qualitatively to the amount of mercaptan sulfur removed by the caustic washing. The decreased requirements of TEL accomplished by efficient scrubbing of gasoline with caustic soda solutions, would result in large economic savings to the petroleum industry.

Addition of certain sulfur compounds to gasoline lowers the octane number of gasoline and reduces the TEL susceptibility, it is agreed by several investigators. Mercaptans were found to decrease the TEL susceptibility and disulfides, formed by the action of "Doctor Solution" (sodium plumbite), were observed to decrease it even more than mercaptans.

The significance of the comparison of "Doctor Sweetening" with caustic soda washing is that the former, with sulfur treatment, leaves the disulfides in the gasoline while the caustic soda wash dissolves the mercaptans and removes them from the gasoline.

Efficient scrubbing of mercaptan-containing gasoline with caustic soda (NaOH) solutions followed by the sodium plumbite treatment produces better tetraethyl lead susceptibility than the same gasoline stock treated only with plumbite solution and sulfur. The spent caustic solutions may be regenerated by boiling and used repeatedly.

OCECO Swing Lines
MEET THE REQUIREMENTS OF PRACTICAL OPERATION



• Oceco swing line equipment consists of a steel nozzle, a heavy duty swing joint that will not twist or leak, a gas-tight stuffing box and cable sheave mounted on the tank top, and winch—all of Oceco's serviceable design and dependable manufacture. Winches are worm geared and self-locking. Oceco swing lines meet any tank requirement. Write for descriptive literature.

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ABSTRACTS OF A.C. . (MILWAUKEE) PAPERS

European Gasoline Substitutes

European motor fuel economics is determined by national defense policies and employment. Alcohol to be munitions raw material. Gustav Egloff, Universal Oil Products Co.

Total consumption of power alcohol in Europe in 1937 was 4.3 per cent of the total motor fuel consumed. This consumption of 510,000 metric tons of power alcohol was less than in 1936 (646,000 tons). The cost to the consumer and state in additional expenditures is estimated in the order of $100,000,000 in subsidies, tax losses, and higher operating costs of vehicles.

The economics involved in substitute motor fuels is not a primary factor. The desire for self-sufficiency explains the production of motor fuels derived from resources such as coal, wood, oil shale, and agricultural products, and also the desire to keep people employed.

The primary substitute motor fuel in Europe is derived from the hydrogenation of coal and carbon monoxide. Germany will produce 17,000,000 barrels per year from units of two processes now operating, under design, and construction. In England the rate of direct coal hydrogenation to gasoline is about 1,300,000 barrels a year. France is operating a 110,000-barrel a year catalytic unit to convert water gas to motor fuel. No other European countries are using these processes at present.

While it is difficult to obtain precise figures on costs of production, various European sources place the cost at 17 to 19 cents per U. S. gallon. In the British Labor Party's report of the operation of the Billingham coal hydrogenation plant, it is pointed out that "although the process is today in successful operation it does not, even with the protection afforded by the British Hydrocarbon Oils Production Act, present a favorable opportunity for the investment of large sums of private capital." Success in the future depends upon the government policy of the day. Evidence appears to indicate that the costs of production by the Fischer-Tropsch hydrogenation of carbon monoxide are not likely to be less than those of the hydrogenation of coal. The British Labor Party's report on "Oil from Coal" goes so far as to state that "Any idea that oil from coal can provide sudden salvation for the coal industry is clearly foolish."

Secured from a number of wholly independent sources abroad, these cost figures conform surprisingly with figures from foreign coal hydrogenation operations translated to U. S. conditions of today by authorities closely in touch with foreign operations. These latter data from American sources indicate 14 to 16 cents per U. S. gallon of motor fuel as the cost which would be obtained in hydrogenating coal in the U. S. today, with present coal prices and freight rates and without the present abundant supply of crude oil.

Germany and Great Britain were also the largest consumers of substitute benzol, Germany producing nearly double Great Britain's tonnage, and more than four times as much as France, third in volume production. Cost to consumers of Europe was $49,463,000 more than it would have had to pay for gasoline, or 20 cents more for each gallon of benzol consumed.

The greatest development in the use of compressed gas for motor fuel has been in Germany, where it is available at many filling stations similar to gasoline stations. Coal gas, methane, ethane, propane, and butane are used for this purpose. It is estimated that over 25,000 German motor vehicles are using about 250,000 cylinders as storage tanks for the compressed gas.

Power alcohol consumption increased in Europe during 1930 to 1936 from 59,000 to 648,000 tons. The drastic drop of 25 per cent in 1937 is expected to be followed by a more drastic drop in 1938. Alcohol as a source of power may be eliminated, due to the staggering economic losses and its diversion to other uses as well as its encroachment upon the food supply of various nations. Germany and France have been the heaviest consumers of power alcohol in Europe, and their supply was derived primarily from sugar beets and potatoes. During 1937 synthetic methanol was used in Germany to the extent of 70,000 tons. The percentage of alcohol required in Germany motor fuel was reduced from 10 to 8.5 per cent in October, 1937, and to 6.9 per cent in April, 1938. Power alcohol consumption in France reached its peak in 1935 with a shrinkage of 52 per cent by 1937. In 1935 France used 55 per cent of the total power alcohol of Europe.

Recent events have confirmed previous analyses showing that the primary reason for compulsory use of alcohol in motor fuel in Europe is the desire of such countries to develop and maintain their alcohol industries for the purpose of national defense, not merely as protection against failure of petroleum supplies in wartime due to blockades, but more particularly to assure adequate capacity in wartime for manufacture of a prime war material in making munitions.

Wood and coal as gas producers are not primary sources of motor fuel even in those countries urging their wider adoption. Wood would soon be exhausted if extensively used. Motor vehicles burning coal give somewhat more difficulty in operation than wood.

The shale oil industry antedates the petroleum industry. European shale motor fuel comes largely from Great Britain. Second is Estonia with a little over one-fourth of Britain's production. Due to more efficient motors of today, the fuel produced from shale oil has required increased blending with higher octane fuels or cracking to raise the octane rating, which increases the cost of production. At the present time competition of shale oil products with petroleum has made the production of oil shale motor fuels a nationalistic problem. The production and use of shale motor fuel has cost the consumer and governments about 15 cents per U. S. gallon above that of imported gasoline due to losses in taxes.

The desperate desire of nations to make themselves self sufficient in substitute motor fuels is reflected in the experimental work going on using such substances as ammonia, hydrogen, and acetylene. Low heating value and high cost handicap ammonia. Experiments on acetylene as a fuel indicated that acetylene cannot do the full work of a gasoline engine and that thermal efficiency is highest with dilute air-gas mixtures. Results with hydrogen do not yet look promising.

Joseph K. Roberts was recently promoted to be Director of Research of Standard Oil Co. of Indiana, succeeding F. W. Sullivan, resigned

GAS BEYOND THE MAINS

A New, Fast Growing Market The Oil Industry Is Helping to Build

Fastest growing of several lines of business which depend on the oil industry for the product they merchandise is the so-called "bottled gas" industry.

Not even recognized as a business ten years ago, today it serves some 400,000 homes over the country with a fuel for cooking, water heating and for refrigerators that ranks in convenience with natural gas and electricity.

Authorities in this business estimate it will add domestic customers at the rate of 100,000 a year for the next five years and that it has a tremendous potential market among the millions of country and small town homes which will not be reached by city or natural gas. The particular properties of this liquefied gas fuel have also been found desirable in certain specialized industrial operations.

In the domestic market, authorities say the bottled gas, which is sold to the consumer on a sliding scale on the basis of from five to ten cents a pound, cannot compete with natural gas and that it can only compete with city gas selling at a rate of $1.50 per 1000 cubic feet and above. The rate to the consumer for electricity, it is said, must be between one and two cents per K.W.H. to allow it to compete with the bottled gas.

Under modern methods this oil industry product is shipped in specially built tank cars and can be stored in steel tanks similar in design to those in which gasoline is stored, but costing three to four times as much because of the necessarily heavier material.

In supplying householders, the practice of distributors at present is to install the tank, piping and fittings on the premises, the cost being around $30. The householder owns the range, hot water heater and other fuel consuming devices.

At present, bottled gas, which can be produced by either natural gasoline plants or by refineries from the gas resulting from their processing operations, is being manufactured by many of the large oil companies. A few have also built up their own distributing systems, advertising and merchandising the product under their own brand names.

Besides these, some companies are wholesale distributors only of bottled gas and over the country there are a large number of small companies and individuals who are distributors of the product to domestic consumers. Local distribution to the present is largely in the hands of agencies which sell the stoves and heaters and install the piping and fittings necessary to use the gas. At present, some oil marketing companies are studying the development of the bottled gas business to see how it will fit into the general business of marketing petroleum products.

Accompanying is a discussion of the future market possibilities in this field and of certain phases of the bottled gas business from reports which have recently come to hand.

AGAIN of 25,000,000 gallons a year, for the next five years, in the use of so-called "bottled gas" in this country was predicted by R. W. Thomas of Detroit, head of Philgas, the liquefied petroleum gas division of the Phillips Petroleum Co., speaking before the annual meeting last spring of the Liquefied Petroleum Gas Association.

This would make the marketed production of liquefied gas, at the end of 1942, about 255,000,000 gallons annually, about twice the estimated marketed production in 1937, he stated.

This increase of 25,000,000 gallons a year, Thomas estimated, would include 10,000,000 gallons as the annual estimated gain in domestic consumption and 15,000,000 gallons for the various industrial, gas manufacturing, miscellaneous and non-bottled gas usages.

He also estimated that at least 100,000 net new customers for bottled gas would be added each year for the coming five years. At the end of 1937, it was estimated there were 400,000 customers for bottled gas in this country, consuming an average of 100 gallons a year each.

"The consumption per customer shows a tendency to increase, due to the intensive load building efforts of the bottled gas marketers," stated Thomas, who was speaking to the association on the subject "As to the Future

How an oil industry product, liquefied gas, brings a most convenient fuel for cooking, heating water and so on to homes in the country and in towns which are not served with gas

of the Liquefied Petroleum Gas Industry." "The load building is along the lines of using gas for water heating, refrigeration, space heating and other convenient types of consumption.

"Gains in consumption due to load building with improved automatic appliances are more than offsetting the trend toward decline in consumption per customer because intense cultivation of certain markets leads to the acquisition of customers with lower than heretofore normal bottled gas buying power."

Equally as striking as his estimates on the growth of consumption of bottled gas was the comment of Thomas on the competition of electricity with bottled gas beyond the gas mains, a factor believed by some to put a definite limitation on the expansion of the domestic bottled gas market.

RECENT statistics, he said, indicate that the Rural Electrification Administration budget totals $85,000,000 available up to June, 1938. At the minimum rate of $1000 per mile for rural lines, this money would build a maximum of only 85,000 miles, which would serve not over 300,000 rural customers, he stated. He said there were reported to be over 6,800,000 farms in the U. S., of which over 5,000,000 are without central station power. "This rural electrification program, even if continued on the present scale, will hardly make a dent in the tremendous available rural cooking market," said Thomas.

He stated that, of the approximately 30,000,000 families in the U. S., over 16,000,000 were using gas of either the manufactured, natural or bottled gas variety. Coal, wood, oil and gasoline are still used for cooking purposes by 12,000,000 families and about 2,000,000 are using electric ranges.

One large factor in the rapidly growing use of bottled gas, stated Thomas, is the fact that the liquefied gases have all the favorable characteristics of gases as far as utilization is concerned, and that their capacity for being concentrated by liquefaction for storage and transportation purposes, in addition, makes possible their handling at relatively much less capital investment than for electricity or gases in that form.

"As an example of this advantageous feature of high concentration of thermal value in small space for storage or transportation," he stated, "it will be noted that a tank car which is capable of holding 10,000 gallons of liquefied petroleum gas and which has an internal volume of about 1400 cubic feet, will hold the thermal equivalent of approximately 2,000,000 cubic feet of city gas, or 1,000,000 cubic feet of natural gas. In the stationary storage tank, propane storage costs about 30 cents per net gallon capacity, which is thus equal to about $1500 per million cubic feet of city gas equivalent, thus making the cost of propane storage less than one-one hundredth of the cost of storing an equivalent amount of thermal value in the form of city gas in an ordinary lift type gas holder of large capacity.

"The capital requirements for transportation and utilization equipment are lower for a liquefied gas than for any other general available form of energy. Electricity must be generated, transmitted and consumed simultaneously, therefore the entire system must be made capable of taking the highest instantaneous peak load that is ever expected to occur. No commercially feasible means of storing electricity in large quantities has ever been devised.

"In the case of city gas, production and consumption do not need to be simultaneous, as the energy in the form of gas can be stored in a reasonably

What is Bottled Gas?

● "Bottled gas" is the term applied to certain fractions of natural gas or refinery gas reduced to liquid form under moderate pressure and vaporizing readily at the temperature conditions met in all parts of this country. The term came into usage several years ago when small 20-pound containers of the liquefied gas were sold in stores for domestic use and bottles returned.

Now, with an enormously expanded market, the liquefied gas is shipped in larger containers and even tank cars and held in bulk storage, like other petroleum products, and deliveries made to storage on the consumer's premises in tank trucks, in some cases. It is used for fuel for cook stoves, for hot water heaters, for refrigerators and to some extent for space heating in homes. This product has special uses in many industries also.

Propane is the particular fraction of natural gas or refinery gas used mostly as bottled gas, although butane and pentane, and mixtures of these three, are used to some extent. The molecular formula of propane is three carbon atoms to eight hydrogen atoms. The formula for methane, the lightest fraction of natural gas, and unsuitable for use as bottled gas, is one carbon atom to four hydrogen atoms.

Some companies check and replenish the householder's supply of liquified gas by tank truck without his having to think about it and he pays monthly only for the amount he has actually consumed

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economical manner in high or low pressure holders, by packing pipelines under pressure, etc., hence there is some flywheel effect between the producing and consuming ends of the system.

"Liquefied gas is even more independent of its source of supply, owing to its economical transportation and storage characteristics. One of the slogans of the industry, 'a liquefied gas installation is the equivalent of a gas well in your back yard,' is literally true."

Thomas does not regard the growing use of the liquefied hydrocarbons through polymerization by the refining industry in the manufacture of the higher octane motor fuels demanded today as limiting the future supply available for the liquefied gas industry.

"The economic value of liquefied gases for these non-fuel purposes is generally considered less than that obtained in the fuel markets," he stated, "hence it is not likely that the competition between these various uses for the same product will result in any dearth of raw material for the fuel or energy purveying section of the liquefied gas industry. With a relatively unlimited supply of raw material and a huge market which has not even approached a saturation point, the liquefied gas industry is destined to continue to grow and to prosper."

Special Equipment Lowers Cost Of Bottled Gas to Consumers

The progress made in developing the special equipment used in transporting and using bottled gas was discussed, at the convention of the Liquefied Petroleum Gas Association by M. G. Farrar of Chicago, of the Bastian-Blessing Co.

Referring to the early days of the industry, he said it was at first thought necessary to employ two regulators, stepping down the pressure of the gas from 30 to 50 pounds in the first stage and then stepping it down to approximately six ounces in the second stage. Tests and field experience soon indicated the entire reduction could be made through one regulator, he stated. Several companies now manufacture these regulators.

Prior to 1930, propane cylinders had a metal weight of 1½ to 1¾ pounds per pound of gas, he stated. Since 1930, under approved ICC specifications, most of the propane cylinders have a metal weight of approximately one pound of metal per pound of gas. The cylinders are equipped with one or more fuse plugs at the top and bottom, or with spring-loaded pop valves to release the gas in the event of excess pressure due to heat.

"During the period from 1920 to 1927, practically all gas was shipped in cylinders, usually by freight, from the processing plants to local points for redistribution by truck," stated Farrar. "Two cylinders were installed on the customer's premises, one of which was in use and one in reserve. This type of system is the one most generally used at the present time and has come to be known as the '2-cylinder system'.

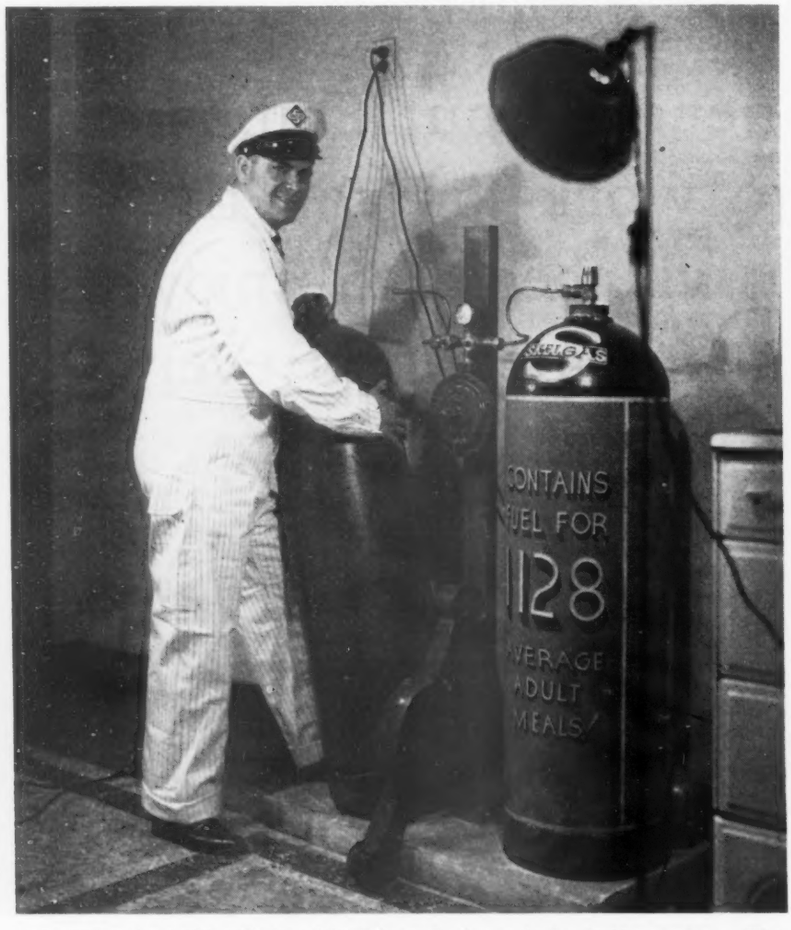
"In 1927, the Phillips Petroleum Co. entered the field with Philgas, using tank wagons from which stationary cylinders, located on customers' premises, were filled. This company also uses, in certain areas, the 2-cylinder system.

"In 1928 the Carbide & Chemicals Corp. erected the first cylinder filling plant at Millwood, N. Y. Gas is shipped from the processing plant in tank cars and stored in storage tanks, from which the cylinders are filled. This marked a definite advance in the industry, in that it permitted bulk shipments at tank car rates. Since that time, that company, as well as many other suppliers, has erected filling stations throughout the country, making long freight shipments of cylinders unnecessary. This is probably the development which has contributed most to the reduction in cost of gas to the consumer."

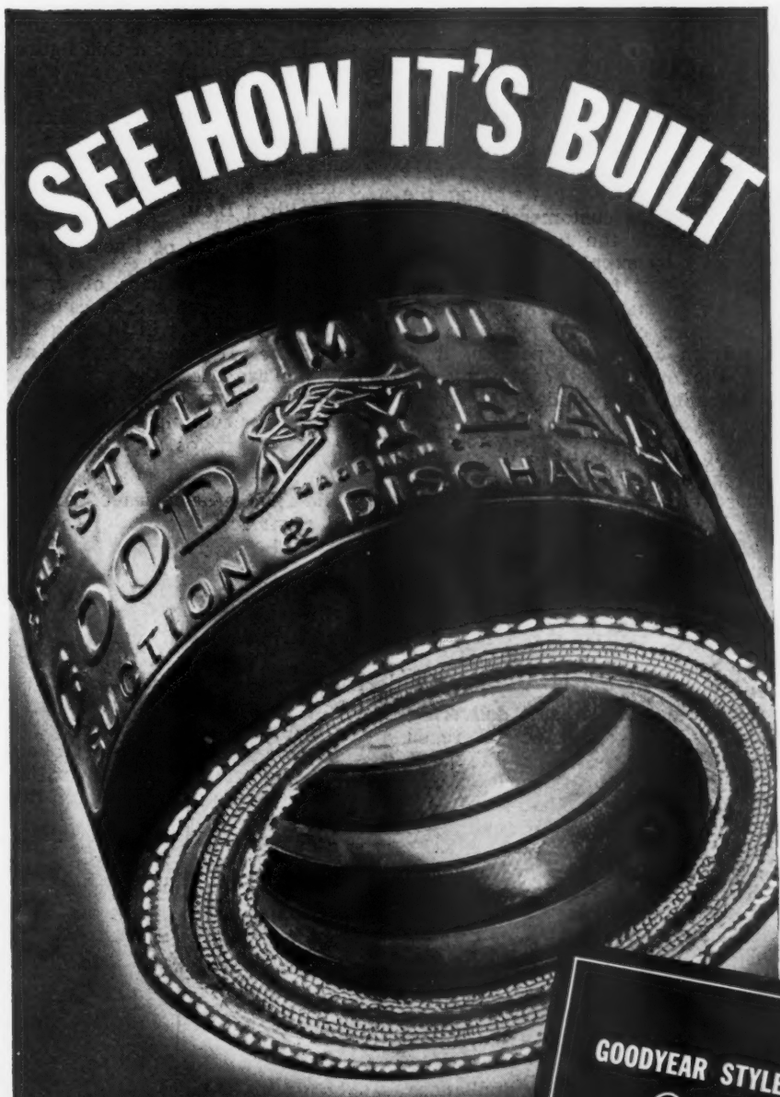
Prior to 1936 all tank cars used in the transporting of liquefied gas were hammer welded, stated Farrar. In that year, he stated, the Interstate Commerce Commission tentatively approved fusion welding and permitted the construction of 50 tank cars welded by the latter method. Experience has indicated that this method will undoubtedly prevail in the future, he said.

As regards the household appliances in which the bottled gas was used, Farrar stated that, prior to 1925, practically all the appliances used were originally made for use with city or natural gas and that it was necessary to adapt them to propane in the field, by inserting proper orifices in the gas cocks and, whenever the construction permitted, by raising the burners.

Many of the appliance manufacturers have co-operated in the adapting of their appliances to the use of the new fuel, he stated, and by 1925, several of the more prominent manufacturers of stoves, heaters, etc., were prepared to properly adapt their appliances before shipment from the factory.



A convenient form of installation of bottled gas for homes is the double container. When the supply in one is exhausted, the connection is switched to the second tank. The supplying company puts in a full tank for the empty one and the householder is always assured a supply. (Photo by Skelgas, Kansas City)



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6. Wire nipple binding wound over maximum number of plies to give greatest end-pull resistance.
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Tank Trucks, Meters Simplify Distribution of "Bottled Gas"

WASHINGTON, Sept. 2.—Late developments in the rapidly growing marketing of the so-called "bottled gas" over the country for domestic use include the servicing from tank trucks of single containers of larger capacity on the consumer's property and the selling of the fuel through meters to the individual customer.

These developments are reported in a circular just issued by the National Bureau of Standards of the U. S. Department of Commerce, to answer the growing volume of questions as to the distribution and utilization of the liquefied propane and butane fractions of natural gas in domestic use. The pamphlet, entitled "Propane, Butane and Related Fuels," is by E. R. Weaver.

The U. S. Bureau of Mines reported that for 1937 total sales of liquefied petroleum gases were 141,500,000 gallons, 33 per cent larger than in 1936 and that the number of domestic consumers being served had reached 400,000, as compared with 50,000 ten years ago. Thus has this allied business of the oil industry grown since the sale of 20-pound containers in stores, to be returned when empty like ginger ale bottles, gave it the name of "bottled gas".

Beyond the Gas Mains

The use of liquefied petroleum gases of greatest importance is that of bringing the advantages of gas service for cooking, water heating and refrigeration to homes beyond the reach of city gas mains, states the Bureau of Standards circular.

For these domestic uses propane, a fraction of natural gas which can be liquefied by moderate pressure and is safe in a container of reasonable strength and yet is a gas at atmospheric pressure at all temperatures likely to be encountered in this country, is said to be as satisfactory as the best manufactured or natural gas service, in every respect except for the inconvenience of replacing empty cylinders.

Unmixed butane is said in the report to be of little use for domestic service except in the warmest parts of the U. S., because temperatures too low to give adequate pressures are frequently encountered elsewhere.

Liquefied petroleum gases are usually sold to the domestic consumer by weight, the Bureau of Standard report says, either directly, by weighing the containers on the customers' premises before and after the fuel is used, or less directly by supplying cylinders of standard content from which the fuel is used until exhausted. The exchangeable cylinders employed range in capacity from 20 to 420 pounds, it is stated, the ones most commonly delivered holding 100 pounds.

When containers too large or inaccessible to be weighed are filled from a tank car or truck, the liquid may be measured either by gaging the levels of the liquid in the container before and after filling or by a liquid flowmeter at the time the fuel is transferred.

Meters Being Used

"To a small but apparently increasing extent, fuel is being sold through gas meters also in systems delivering gas to only one customer each," reads the report. "This method has the merit that the volume of gas used is permanently registered on the meter dials and can be checked at any time by the purchaser. Even if a mistake is made in reading the meter it can be rectified the next time the meter is read. To check the weight or volume of liquid fuel, the purchaser must be present at the time of delivery or make measurements for himself before any fuel is used." Other factors contribute to offset the advantage of the use of meters, however, the report states.

The report points out that appliances for using propane gas differ from those built to use natural or artificial gas only in minor ways and that the costs of such appliances should not be much higher.

The source of supply of the liquefied petroleum gases is both the natural gasoline companies and the refineries, both of which are said to constitute great potential sources. The total quantity which could be obtained from these sources is said in the report to be greatly in excess of any possible demand for domestic uses other than househeating. The use of liquefied gases for space heating is very limited as yet, although developments of this use are expected to enlarge the market later.

The Bureau of Standards report comments briefly on the cost to the consumer of propane as varying with the locality and depending largely on the transportation and distribution costs. Propane for domestic supply retails at between 6 and 10 cents a pound, the report states, pentane and the mixed hydrocarbons being usually cheaper.

"For purposes of comparison, it may be noted that pure propane at 10 cents a pound costs $4.61 per million B.t.u.," says the report. "The other fuels differ only a little from this figure. The 600 B.t.u. gas supplied in Washington, D. C., at 90 cents per thousand cubic feet costs $1.50 per million B.t.u. Kerosine at 10 cents per gallon costs 78 cents per million B.t.u. Electricity at 3 cents per kilowatt-hour costs $8.79 per million B.t.u.

Cost of Fuels

"Relative efficiencies of application of the heat in use are, of course, to be taken into account in judging the cost of service. If appliances designed for propane are used, there will be some improvement in efficiency when using propane for cooking as compared with city gas; perhaps as much as 10 per cent.

"Relative efficiencies of bottled gas and electricity are harder to estimate, largely because of differences in the way in which they are used. As a rough estimate, based on what is believed to be average practice, the cost of bottled gas and electricity will be equal for cooking if the price of fuel per pound is 3½ times the cost of electricity per kilowatt-hour. Water heating will cost about the same if the price of a pound of propane is about 4½ times that of a kilowatt-hour, but for equal costs for refrigeration the two prices must be approximately equal. It is assumed that appliances of comparable quality will be used in each case. Kerosine will equal propane in cost for cooking if the price per gallon is about 4 times the cost of propane per pound; for water heating if it is about 5½ times as great."

Copies of the complete report of the U. S. Bureau of Standards report on bottled gas, entitled "Propane, Butane and Related Fuels," can be secured by writing the Supt. of Documents, Washington. Copies are 5 cents each.

MANY of the leading oil companies are active in the production of the propane and butane bottled-gas fuels. The following companies are listed as producers, with their trade-named product marketed also through a system of resellers: Barnsdall Oil Co., Standard Oil Co. of New Jersey, Standard Oil Co. of Kentucky, General Petroleum Corp. of Los Angeles, Bradford Gasoline Co., Phillips Petroleum Co., Skelly Oil Co.

Other oil companies listed as producers of a trade-brand bottled gas fuel are: Standard Oil Co. of California, Standard Oil Co. of Louisiana, Shell Petroleum Corp. of St. Louis, Shell Oil Co. of California, Sloan and Zook, Wasatch Oil Refining Co. of Utah.

Other oil companies are listed in the report as important producers for which no trade name has been reported to the Bureau of Standards for their products: Cannon Gasoline Co. of Amarillo, Texas, Carter Oil Co. of Tulsa, Cities Service Oil Co. of Tulsa, Cumberland Gasoline Co. of Cleveland, Humble Oil and Refining Co., Standard Oil Co. of Indiana, Standard Oil Co. of Ohio, Union Oil Co. of California, Westoak Gasoline Co. of Sayre, Okla.

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Using NPN Station Forms To Fix Adequate Lighting

A method is presented in this article by which the station operator can figure for himself, with the use of the NPN Service Station Inspection Form, the amount his light bill will be increased per month where he provides adequate lighting.

NPN's inspector reporter believes one more car a day on the station drive, in many cases will pay the difference between the cost of adequate lighting and the cost where the operator has cut down on this service to save on his operating cost.

Poor lighting may be due to the condition of bulbs and reflectors as well as to the use of too low wattage lamps, it is brought out. The remedy in this case many times is a matter of better housekeeping only.

THE difference between the cost of adequate station lighting, as measured by the NPN Inspection Form for Service Stations, and the actual lighting cost, at one of the typically lighted stations recently inspected by an NPN reporter, was found to be $6.74 a month, on the assumed basis of three hours operation per day of the station's lighting system.

In terms of gasoline sales profit alone the increased cost would be repaid if the additional light attracted one more gasoline customer per evening for from 5.6 to 7.5 gallons of gasoline depending upon whether the profit margin per gallon were 4 cents or 3 cents a gallon.

The actual total wattage of all the lamps in this station was close to 2600 watts at the time of the inspection. By accepted lighting standards and using the same number of outlets it was estimated that 5250 watts should be used. In spite of this nearly doubled consumption of electricity the cost to this station would be increased only from $9.36 to $16.10 a month because the rate for the additional electric current is only 2.8 cents per kilowatt hour whereas the first 240 kilowatt hours costs 4 cents per kwh. While these same actual rates might not apply in the cases of many stations, the principle pretty generally holds of a lower unit rate as the volume of current used increases.

Computation of kilowatt-hour consumption on the assumed basis is a simple matter for any station owner or operator to compute. Wattage is reduced to kilowatts by dividing by 1000, multiplied by three (hours per day) and then by 30 (days per month). 5.25 x 3 x 30 = 472.5 kwh. and 2.6 x 3 x 30 = 234 kwh.

Cost of 234 kwh. at this station is 234 x 4 (cents per kwh.) or $9.36. Cost of 472.5 kwh. is 240 x 4 plus 232.5 x 2.8 or $9.60 plus $6.50 which totals $16.10. The difference in the two costs is $6.74. To reduce this amount to the equivalent of profits on 5.6 gallons of gasoline per day, the $6.74 was divided by 4 (cents per gallon profit) and then by 30 (days per month). The first division gives 169 gallons per month and the second gives 5.6 gallons per day. Similar computations for 3.5 and 3-cent margins gives 6.4 and 7.5 gallons per day sales necessary to pay the additional costs of adequate lighting.

Any station operator can determine the actual wattage in his lamps by adding up the figures given on the end of the bulbs, providing they are reputable U. S. makes. Make sure that the wattage (W) figure is used and not voltage (V). The value they ought to be can be determined by reference to the NPN Service Station Inspection Form or by getting the recommendation of his local electric power company, or even observing the practice of leading oil companies. The figure may vary somewhat depending upon the number of fixtures required.

LIGHTING, which has proved to be the commonest substandard at all stations "inspected" under the NPN rating system, is one of the easiest items on which to skimp in operating a station. Adequate sizes of bulbs are not the whole answer to the problem, of course. It has been shown by lighting engineers that clean bulbs and reflectors are also necessary for top efficiency. An excellent record of clean lighting fixtures has been found at nearly all stations. Lamps and reflectors should be cleaned at least once a month and more frequently in areas where atmospheric conditions are bad.

Lamps blackened on the inside by long service often cut efficiency to the point it is actually cheaper from the standpoint of purchased light units to discard the bulb and replace it with a new one. A safe rule, it is said, is to discard lamps after 1000 hours of service whether burned out or not.

Another important factor in station lighting costs is adequate wiring to assure the lamps receive the right voltage. A five per cent voltage drop between the electric meter and lamp, caused by too small diameter wire, will cut a lamp's efficiency 14 per cent, according to lighting engineers.

In exact opposite to commonly accepted belief is the fact that, the lighter the street or surroundings of a station , the more light is required in the station drives to afford attractive contrast. For example, a station on a dark

Tool boards in the lubrication department not only save the operator's time in performing the given task, but they save part of the loss in small tools which all stations experience. Good station housekeeping, as found on NPN's inspections, includes tool boards and the tools kept in place there when not in use

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These three views of one of the new tank trucks of the Atlantic Refining Company show the use of S. & J. Internal Hydraulic Valve System, which is built into each of their fleet of such trucks.

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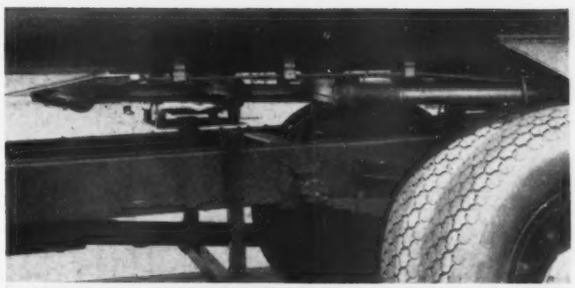
Operators who are not familiar with the S. & J. Internal Hydraulic System are invited to write for a free copy of our book, "Transporting Inflammable Liquids with Safety", which illustrates and describes it in detail. Full information regarding installation, operation and maintenance of S. & J. Internal Hydraulic System for new tanks or those in service, available upon request.



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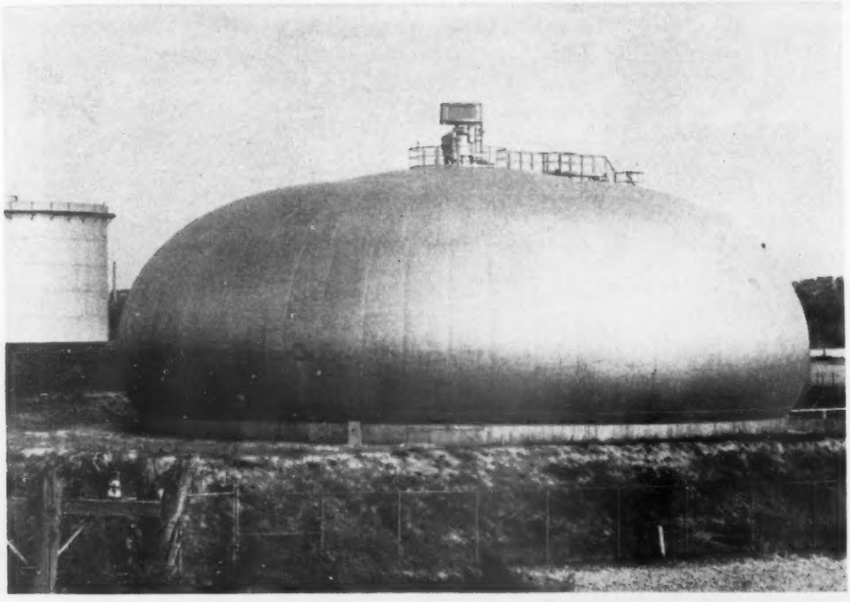

for Motor Gasoline Storage

THE Hortonspheroid is particularly well suited for storing high test motor fuels in large quantities at 2½ lbs. pressure. By storing gasoline under this pressure, you not only prevent the lowering of the octane rating but also stop volumetric loss through evaporation.

The rapidly increasing number of Hortonspheroid installations in all parts of the world is ample proof of the practicability of this modern unit. From a cost standpoint, the unique design results in a highly favorable balance of economy with capacity. Units for handling motor fuels are available in standard sizes ranging from 10,000 to 100,000-bbls. or more.

The Hortonspheroid shown in the picture above has a capacity of 60,000-bbls., and is used for motor gasoline storage at a Nashville, Tenn., gasoline terminal. Three flat-bottom tanks at this terminal are equipped with Wiggins Pontoon Roofs. For complete information address our nearest office.

Chicago Bridge & Iron Company

Cleveland.....2206 Rockefeller Bldg.
Chicago.....2125 Old Colony Bldg.
New York.....3345—165 Broadway Bldg.
Philadelphia...1614—1700 Walnut Street Bldg.
Boston.....1516 Consolidated Gas Bldg.
Detroit.....1513 Lafayette Bldg.
Dallas.....1439 Liberty Bank Bldg.
Birmingham.....1534 N. Fiftieth Street
Houston.....2919 Main Street
Tulsa.....1607 Hunt Bldg.
San Francisco.....1060 Rialto Bldg.
Los Angeles.....1422 Wm. Fox Bldg.

FABRICATING PLANTS in Birmingham, Chicago and Greenville, Pa.

LICENSEES: The Motherwell Bridge & Engineering Co., Ltd., Motherwell, Scotland; The Whessoe Foundry & Equipment Co. Ltd., London, England; Worms & Cie., Paris, France; Compagnie Tecnica Industrie Petroli S. A. I., Rome, Italy.

country road may be able to use 200-watt floodlights successfully because of the sharp contrast to the general darkness. The opposite extreme are the shop windows on the "white ways" in cities' business districts. These are the displays which employ the highest powered bulbs rather than the windows on the less well lighted streets. The nearby street light, rather than being an advantage to a station, often proves to be a disadvantage, lighting engineers assert.

While this particular property in Cleveland is among the best kept stations that have been inspected with the aid of the NPN Inspection Form, still in regard to its lighting it is typical of the major portion of leased and independent stations visited by an NPN inspector.

Exceptionally well kept hedges, flowers and lawn were the lure which prompted the inspection. Closer scrutiny resulting from following up the 200 odd questions in the NPN Inspection Form showed an interior orderliness equivalent to the exterior.

RATING 90 per cent by the inspection form, the station has shown a continuous gain in gallonage since the station was leased to the present operator; and the gains were not all lost during the present business recession.

Gasoline throughput was increased 50 per cent without discounts to any customers, it was stated, and without offering premiums or trading stamps. The only inducement offered to an occasional customer during the present season has been a large ripe tomato from the vines growing at the rear of the station. Most customers are "tickled to death" by the unusual present, according to the proprietor and they usually remember where the tomato came from the next time the gasoline tank is empty.

This operator has built his business by two programs not previously in effect and he has discarded one of the merchandising plans pushed by many stations. In this change he has demonstrated that not every station can use the same tactics. The discarded plan is pump island sales efforts on accessories. His customers, he said, appreciate not being continually asked to buy things that they may need later on but not at the moment.

Substituted for this program is personal attention and development of acquaintance among customers. Only the urgent need for a tire, battery or other accessory is brought to the customer's attention. Trading of gasoline for household necessities is the second reason for growth of gallonage. Neighborhood merchants who have taken gasoline in trade still return for gasoline when the bill is paid, the station operator reports. Similarly the services of neighborhood carpenters, plumbers, plasterers, and electricians were obtained.

Typical of the careful attention to orderliness at this station is the provision of two tool boards in addition to

the grease gun rack, with places for all tools in common use. The chief value of the tool racks, it was said, is in saving time looking for tools. The loss of tools is not entirely eliminated, it was brought out, but the tools also have a longer service life because of the better care they are given.

Gasoline losses here average about 0.38 per cent of throughput. Actual station loss is 0.28 per cent since 0.1 per cent is allowed by the supplier. This loss is one which is subject to little variation as long as the pumps are accurate and the pumps are checked regularly for accuracy.

Turning attention to the 10 per cent of items which did not meet the specifications of the NPN questionnaire, it should be pointed out that the casual observer would find it difficult to isolate the demerits which brought the score down to 90 per cent. The lack of a bowl stopper in the rest room cost the station one demerit and inconspicuous rest room signs another. Several of the other substandards were no more serious than these. Not uncommon is the practice of piling stock around the compressor, yet it costs another one-half per cent drop in the inspection score, like every other "no" answer in the questionnaire. The replacement of concentrating reflectors instead of floodlight reflectors, and use of lower powered floodlight bulbs puts the same intensity of light on the drive but on a smaller area, but it took off another one-half per cent in this station's rating.

Above the average in many respects, many stations, like this one, require only a touch here and a small item there to reach the highest score that can be made by any station. In almost all cases, lighting is one subject to which station owners and operators could give attention, not only to improve the station's efficiency rating but also—and of more concern to them—to help their sales.

Dormant Bank Accounts Publicized By Texaco

A novel sales promotion plan to inform the public where dormant bank accounts exist, is now being tested in the Boston area by The Texas Co. known as the Texaco Treasure Hunt, the plan involves the use of five Boston newspapers and two local radio stations.

An important feature will be the use of large bulletins which will be prominently displayed at all Texaco dealer stations. These bulletins are being changed twice a week and contain detailed information not given in the newspaper and radio advertising.

To participate in the Texaco Treasure Hunt, the public is not required to lay out any money, solve any puzzles or enter any contests. Company sales officials are hopeful the plan will assist the banks in locating the proper owners or heirs.

WHY SEND SO MUCH HEAT TO THE CEILING?..MEN DON'T WORK UP THERE!

This new Superfex Oil Heater directs warmth to the "working zone,". . . gives both radiant and circulated heat.

Here's where heat goes! A circulating heater sends hot air to the ceiling (see dotted lines) then it slowly sinks lower in the room and also helps warm adjoining rooms. The Superfex Heat-Director does this too, *but* its Comfort-Controls *also* send warm, *radiant* heat in the "working zone" (see arrows). This radiant heat is like the heat from the sun, and can be *directed* down to the floor or straight out into the room...whichever you wish. *Only* Superfex has this vital advantage.

The Superfex Heat-Director operates hour after hour without attention. Heat can be accurately regulated by merely turning a dial. Thermostatic control for overnight heating and special attachment for providing hot water radiation in washroom are available. No odor, no soot—and economical, for it burns a wide variety of inexpensive fuel oils. Permanent connections for use with outside fuel storage can be had. Sizes and models to fill every service station need. Full information on request—send the coupon.

RADIANT HEATERS, TOO
Superfex Radiant Heaters are available in several sizes for use where radiant heat only is desired.

SUPERFEX
OIL BURNING HEATERS
A PRODUCT OF PERFECTION STOVE COMPANY

The Mark of Quality

PERFECTION STOVE COMPANY, 7614-A Platt Avenue, Cleveland, Ohio

Please send descriptive booklets as checked:
- ☐ SUPERFEX Heat-Directors and Radiating Heaters
- ☐ PERFECTION Portable Room Heaters
- ☐ SUPERFEX O.I Burning Air Conditioning Furnaces

Name_____ St. or R. F. D._____

Post Office_____ County_____ State_____

"Seven Wonders" Is Shell's Theme

THE Shell Oil Co. of Canada, Ltd. is using in its 1938 advertising campaign a variation of the theme it first adopted in 1936 keyed to the world wide activities of the Royal-Dutch Shell interests. Its current campaign is called "The Seven Wonders of the World" and ties in with the "World Experience in Every Gallon" story which the company used for the past two years.

Some indication of the popular appeal of the series of posters worked up in the earlier campaign is shown in the fact that the company has received more than 16,000 requests from schools, libraries, universities and clubs throughout Canada for reproductions of the posters.

To illustrate "World Experience in Every Gallon", the company used posters each of which pictured a distinctive type of object for many foreign lands. Thus one poster showed a variety of early sailing craft, labeling each for the appropriate country. Thus a canoe, viking ship, gondola and outrigger were on a poster, labeled Canada, Norway, Italy and the Philippines respectively, together with 13 other types of craft each labeled for the country for which it is distinctive.

One of the "World Experience in Every Gallon" posters used by Shell Oil Co. of Canada, Ltd., in its 1937 campaign

A photograph of the first poster of the "Seven Wonders of the World" series being used by Shell Oil Co. of Canada Ltd. as its advertising theme for 1938, and carrying out the general theme of "World Experience in Every Gallon" which the company used successfully in 1936 and 1937

• • •

Another poster displayed postage stamps of various nations, another gave characteristic national silhouettes, a junk for China, Royal Mounted Trooper for Canada, skyscrapers for the U. S., an elephant for Africa, jinriksha for Japan, the Eifel tower for France, kangaroo for Australia and the like. An aeronautical design artist co-operated to produce a poster showing authentic reproductions of airplanes of 15 nations.

C. W. Chamberlin of Toronto, advertising manager of Shell of Canada, said that 6000 unsolicited requests were received by the company in 1936 from various sources for reproductions of the posters and that 8000 requests were received by the company in 1937. In response to requests from schools of art design and clubs and libraries, the company made up an exhibit of 40 framed original drawings of the billboard posters. The exhibit time of any one requestant was limited to ten days, but requests for the exhibit were

BRADFORD OIL REFINING COMPANY
Announces the completion of its
New Lubricating Plant
Latest improved type of equipment and process
Highest quality of products
Refined exclusively from
Famous Bradford, Pennsylvania Premium Crude
We offer:
HIGH FLASH CYLINDER STOCKS
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NEUTRALS — MOTOR OILS
In tank cars, drums and cans
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100% PURE PENNSYLVANIA OIL
BRADFORD OIL REFINING COMPANY
BRADFORD, PENNSYLVANIA

received at such a rate that it was booked nine months in advance.

In the 1938 advertising theme of the "Seven Wonders of the World", newspapers, direct mail, station displays, magazines, motion picture advertising, school educational material as well as billboard posters will be used. Paintings of each of the seven wonders of the world were made by Jac. de C. Leonardo, artist-designer of New York. Brilliant contrasting colors are being combined with striking effect in the new poster designs, red being used with green, for example, orange with blue and yellow with purple.

In the direct mail campaign, postcards with colored reproductions of the Seven Wonders are to be actually stamped and mailed in the modern cities which are located nearest to the sites of each of the ancient Seven Wonders. Colored reproductions of the posters depicting each of the original Seven Wonders, three feet by eight feet in size, will be shown on special standards at Canadian Shell stations. A 16-page booklet, containing black and white etchings and the stories of the Seven Wonders are to be given away at the Shell stations. A series of party sheet games with four sets of seven questions each, based on the seven wonders, will also be given away at the stations.

Library collection sheets with full colored reproductions of each of the posters and complete information concerning their subject matter will be available for schools and libraries throughout Canada.

After the completion of the campaign, the original poster paintings will be uniformly framed and sent on an exhibition tour to schools, universities, clubs and libraries throughout Canada. Colored slide films of each of the paintings with vocal, synchronized transcription lectures will be loaned to schools and educational organizations.

The "Seven Wonders of the World Campaign" was originated and directed by Porter F. Leach of New York, merchandising and advertising consultant for the Shell Oil Co. of Canada, Ltd.

Early this year an art poster contest was conducted among students of five schools of art design, the first three best posters in each school competing for the final selections, the grand prize winner, a New York department store girl, receiving $300. All the posters carried the slogan, "World Experience in Every Gallon", and illustrated the theme in an original manner.

TRADEMARKS

The following are trademark applications pertinent to our field pending in the United States Patent Office which have been passed for publication and are in line for early registration unless opposition is filed promptly. For further information address National Trade-Mark Company, Munsey Building, Washington, D. C., trademark specialists.

As an additional service feature to its readers, this journal gladly offers to them an advance search free of charge on any mark they may contemplate adopting or registering. You may communicate with the Editor of this Department, or send your inquiry direct to the National Trade-Mark Company, stating that you are a reader of this journal.

HUDSON OIL CO. HI-OCTANE GAS TRANSPORT GASOLINE, and design. Ser. No. 407,550. Hudson Oil Co., Kansas City, Mo. Filed June 16, 1938.

For gasoline.

INTERNATIONAL LUBRICATION, and triangle within a double circle. Ser. No. 393,957. International Lubricant Corporation, New Orleans, La. Filed June 11, 1937.

For petroleum products — namely, lubricating oils and greases.

TANGENT. Ser. No. 407,697. Tangent Oil Cup Co., Seattle, Wash. Filed June 20, 1938.

For oil cups.

PERMATEX TOON-OYL, on design. Ser. No. 398,170. Permatex Company, Inc., Brooklyn, N. Y. Filed Oct. 5, 1937.

For lubricating oil for degumming, decarbonizing and prevention of formation of sludge in the interior working parts of internal combustion engines.

COSMIC-RAY. Ser. No. 407,243. Ray T. Parfet, doing business as Cosmic-Ray Enterprises, Kalamazoo, Mich. Filed June 8, 1938.

For motor oil.

NUFF-SAID. Ser. No. 407,542. Henry C. Greenwald, Madison, Wis. Filed June 16, 1938.

For lubricating oil compound used for general lubrication purposes and particularly for lubricating the differential, etc.

Brookins
WINTER NECESSITIES
You need up-to-the-minute Brookins equipment for fast, efficient servicing of cars this winter.
MODEL 1135 CAN-SPOUT — Simple, one-hand operation — has no-leak vent. Low cost. For 1 and 5 quart cans.
MODEL 512 COMBINATION MEASURE — Built from heavy gauge stock. Has rigid spout, galvanized, tin plate or highly polished copper finish. 1, 2 and 4 quart sizes.
MODEL 601 CANNED OIL DISPENSER — Cuts both top and side of can. Has polished copper finish, long rigid spout with flow control and patented sloping bottom.
MODEL 503 RADIATOR FILLER — Extra long spout. Easily reaches ALL radiator intakes. Hot-dip galvanized. 12 quart capacity.
ZERO
(Left) MODEL 672 COMBINATION MEASURE — Sturdily built. Has long flexible spout. Is hot-dipped galvanized. 1, 2 and 4 quart sizes.
(Right) MODEL 1002 MEASURE, MODEL 650 DISPENSER — Efficient combination for dispensing alcohol, kerosene or light oil. Measure has patented sloping bottom, long rigid spout, easy flow control. Dispenser fits all bungs. Needs no adjustment. Safety valve.
THE BROOKINS MFG. COMPANY
DIVISION OF CINCINNATI BALL CRANK CO., CINCINNATI, OHIO

Lubrication Is Being Stressed In Company-Dealer Programs

By John W. Thompson

N. P. N. Staff Writer

LUBRICATION service at the oil company station is beginning to take on a new meaning for many companies to be more than just a grease job. Today, for the alert operator, it is a lubrication job, plus a long line of other profit possibilities, including oil changing, gear lubricant flushing and refilling, and tire, battery and accessory replacements.

Oil companies are becoming noticeably active in developing plans and sales material which will encourage their dealers to recognize that lubrication service, intelligently exploited, can mean more in profit returns than just the profit on lubrication alone.

The Sun Oil Co., for example, has recently developed and distributed to its dealers a rotating disc chart, known as "Your Profit Prophet". This chart, divided into monthly station gallonages of 1000, 3000, 5000, 7000, 10,000, and 15,000, breaks down under each section the amount spent by motorists as represented by those particular gallonage classifications.

Lubrication service is described by Sun as the "Hub of Profit", and the actual lubrication job itself is shown as offering 85 per cent gross profit, among the highest of any of the station services listed.

The compilation on the chart is based on the estimate that a motorist buys 600 gallons of gasoline a year, and drives 9000 miles. According to the Sun chart, he buys during the year six lubrication jobs, 12 gallons of motor oil, 1 1/3 tires and tubes, ½ battery, six car washes, and in addition gear lubricant and motor flushes, accessories, and miscellaneous labor, totaling $20.95.

To make a station a good "Profit Hub", Sun points out in its dealer house organ, the Sunoco Diamond, that 10 lube jobs should be sold for every 1000 gallons of gasoline, that the station should average 7 oil changes to every 10 lube jobs, that it should sell 2 flushing jobs per year per customer and that it should sell 12 pounds of gear lubricant per year per customer.

A number of oil companies are offering their dealers complete lubrication selling plans, including manuals, record cards, service tickets, post card reminders and all the other items which go to make up a well rounded attack for lubrication business and other selling opportunities.

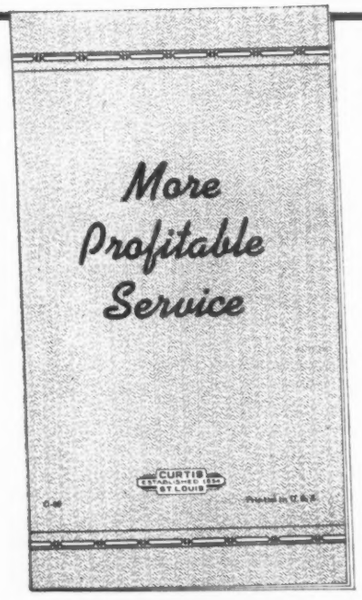
One such plan is offered to its dealers by the Mid-Continent Petroleum Corp. of Tulsa, in what it terms the "Diamond Guaranteed Lubrication Plan".

The dealer's lubrication guarantee to the customer reads:

"The undersigned guarantees that all points of lubrication on your car, as shown by the diagram, have been properly lubricated with the special kind of lubricant recommended by the car manufacturer. If you are not absolutely satisfied therewith you may return your car with this ticket, within a reasonable period of time or mileage, and have your car re-lubricated. If we cannot satisfactorily lubricate your car we will gladly refund your money."

The Diamond plan includes a lubrication manual, giving diagrams and lubrication instructions on the various makes and models of cars from 1934

ASK CURTIS for your copy of "More Profitable Service"



CURTIS
LIFTS • COMPRESSORS
CAR WASHERS
ST. LOUIS • NEW YORK • CHICAGO
SAN FRANCISCO • PORTLAND

New, free booklet to help you increase sales and earnings

You want to make more money out of your service station, or service department. Many practical ideas about service merchandising and equipment are summed up in a new Curtis booklet, "More Profitable Service." It is full of meat, clear, non-technical and easy to read. It tells you how to attract more customers, how to sell them more service, and how to step up the profit on service jobs.

Here are just a few of the subjects covered—The history and development of the service station—The market for service—What certain kinds of service equipment will do for you—Profit possibilities—How to select the proper types of equipment—Cautions as to service—Specific benefits resulting from broader service—Service as the car owner likes it—How to get service business—The woman driver—and so on.

This booklet is absolutely free for the asking—no obligations. For a minute's trouble you may get some real ideas that will make more money for you. Mail the coupon below for your copy.

CURTIS PNEUMATIC MACHINERY CO., 1965 Kienlen Avenue, St. Louis, Mo.
Gentlemen: Please send me, without obligation, your new, free booklet, "More Profitable Service."

Name_____

Street_____

City_____ State_____

My Jobber_____

through the current year. Augmenting this is a lubrication bulletin, sent out periodically and designed to keep the station operator informed on automotive developments and current lubrication changes.

There is also provided a leatherette holder to be attached under the hood of the customer's car, which contains a card for recording the purchases of lubrication services. It is valuable, too, as it provides any dealer with the customer's name, address, and record of purchases.

As an additional part of the Diamond Plan there is a series of four two-color postcards, to be used for solicitation of wheel packs, general lubrication business, and to notify customers when their cars are in need of lubrication service.

A lubrication record card and file box are included. The card provides spaces for recording lubrication and other services performed on the customer's car. Dates on the cards enable the attendant to follow up the customer when his car is in need of battery tires or lubrication service.

An important item in the Diamond Plan, and one which is growing in importance in service station operation generally, is the dealer service ticket. It provides spaces for practically all services performed at the station; it serves as a receipt and an itemized statement for the customer and it provides a written guarantee of good workmanship.

On the back of the ticket is a dia-

Profit Possibilities In "Other" Sales at Stations

The average motorist, who buys 600 gallons of gasoline a year and drives his car 9000 miles, buys other automotive merchandise and services in which there is a total gross profit of $30.78, according to the Sun Oil Co.'s Profit Prophet. This is a chart put out by that company, by means of which a station operator can estimate his possible total sales, based on his actual gasoline gallonage.

The list of services and merchandise which accompany 9000 miles of driving are listed as follows:

Item	Amount	% of Gross Profit	Gross Profit
6 lube jobs, $1 each	$6.00	85	$5.10
12 gallons motor oil, $1 per gallon	12.00	55	6.60
Gear lubricant and motor flushes	4.50	64	2.90
Miscellaneous labor	3.00	85	2.55
Accessories	13.45	40	5.38
1 1/3 tires and tubes	14.00	25	3.45
½ battery, plus rental and charging	4.00	30	1.20
6 car washes, $1 each	6.00	60	3.60

Motor oil sales were figured at a 50 to 1 ratio, whereas national average consumption is 43 gallons of gasoline to one of oil.

Gear lube and motor flushing sales were based on two complete changes (rear axle and transmission) yearly, requiring 12 pounds at 25 cents per pound; also two motor flushes requiring 10 quarts at 15 cents a quart.

Miscellaneous labor includes four tube repairs at 50 cents each and $1 for small mechanical adjustments.

Accessories include the sale of seven essential items — five spark plugs at 65 cents each; three lamps at 20 cents each; one fan belt at 90 cents; one oil filter cartridge at $2.75; one wiper blade at 45 cents; ½ set of skid chains and replacement links at $3.50 and $2 for anti-freeze.

On tire sales, the average tire life was figured at 27,000 miles, thus requiring the motorist to replace 1 1/3 tires per year.

When purchasing your fuel and furnace oil

requirements, kindly bear in mind that BERRY'S specialize in domestic heating oils from both our seaboard terminals and Pennsylvania refineries.

Attractive quotations may be secured on range oil, No. 1 and No. 2 fuel oil.

Gasoline of high octane and specific distillation range are also available at all of our shipping points. Your inquiries will be appreciated on any commodities which you might purchase.

JAMES B. BERRY SONS' CO., INC. OIL CITY, PA.

Branch Offices: New York City; Chicago, Ill.; Boston, Mass.; Philadelphia, Pa.; Houston, Texas; London, England; Hamburg, Germany; The Hague, Holland.

Refineries: Oil City, Pa.; Emlenton, Pa.; Farmer's Valley, Pa.; St. Mary's, W. Va.
Ocean Terminals: Baltimore, Md.; Tiverton, R. I.; Dorchester, Mass.; Carteret, N. J.; Edgewater, N. J.; Glastonbury, Conn.; Philadelphia, Pa.

"Indispensable to the oil engineer, technologist and chemist . . . a complete reference work covering the entire world of petroleum."

—National Petroleum News

The SCIENCE of PETROLEUM

A Comprehensive Treatise of the Principles and Practice of the Production, Refining, Transport, and Distribution of Mineral Oil

Editors

B. T. Brooks — **A. E. Dunstan**
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3192 pages. Fully illustrated
Over Three Million Words

PREFACE BY
WALTER C. TEAGLE

"It is packed with so much fine information from a fundamental and practical standpoint that it should be a part of the library of anyone interested even in the slightest degree in petroleum and its products. It is a masterpiece!"
—Dr. Gustav Egloff

"A most important publication achievement. It should be of inestimable value not only to the scientist . . . but to every inquiring individual be he student, technologist, marketer, or business man . . . The books give a complete story of petroleum from its origin to its utilization."
—*S. A. E. Journal*

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OXFORD UNIVERSITY PRESS
114 Fifth Avenue **New York**

gram of the customer's car which serves as a confidence-builder, as it informs the customer that the attendant knows the places on his car that require lubrication.

The dealer service ticket has also developed as an excellent check for the attendant, to make certain that he has covered every point on the car. In the present type of dealer and lessee-operated stations, this ticket provides a personal check-up for the attendant on his own work, and reduces the possibility of his neglecting to fill the transmission, or to refill the crankcase after old oil has been drained out, or to check the differential oil level.

The service ticket, in a measure, takes the place of the supervision that was formerly practiced by the oil company when it was operating its own stations, and is a check on the car and on the station operator.

The Mid-Continent company reports, also, that these dealer service tickets

DIAMOND DEALER'S SERVICE TICKET

Date _____
Customer _____
Address _____ (PHONE)

STUDEBAKER

LICENSE NO.	MAKE OF CAR	SPEEDOMETER	JOB PROMISED

Service Desired	SERVICE	Service Done	PRODUCT	QUANTITY	PRICE	AMOUNT
	Diamond Guaranteed Lube					
	Motor Fuel					
	Crankcase — Drain / Check					
	Transmission — Drain / Check					
	Differential — Drain / Check					
	Flushing Serv. — Crankcase / Transmission / Differential					
	Wheels — Check / Repack					
	Springs — Check / Covered					
	Radiator — Water / Anti-Freeze / Flush					
	Battery — Water / Charge / Cables					
	Tires & Tubes — Air / Inspect / Repairs					
	Lights — Check / Replace					
	Spark Plugs — Clean / Replace					
	Car Wash					
	Miscellaneous				TOTAL	

CUSTOMER'S RECEIPT AND GUARANTEE

DIAMOND DEALER'S LUBRICATION GUARANTEE

The undersigned guarantees that all points of lubrication on your car, as shown by the diagram, have been properly lubricated with the special kind of lubricant recommended by the car manufacturer. If you are not absolutely satisfied therewith you may return your car with this ticket, within a reasonable period of time or mileage, and have your car relubricated. If we cannot satisfactorily lubricate your car we will gladly refund your money.

Dealer _____ Address _____
By _____ Town _____

Copyright, Mid-Continent Petroleum Corp.

The Mid-Continent Petroleum Corp. of Tulsa makes these service tickets available to its dealers to aid them in insuring a thorough lubrication service is performed. Separate tickets are provided for each make of car and on the back of the receipt is a lubrication diagram of the customer's car. The company's lubrication guarantee is included on the receipt

increase sales, as the attendant needs only to go over the ticket with the customer and inquire which of the services he needs. This company says that startling reports are frequently received showing the success of these service tickets in building up sales.

The company reports it is not uncommon among its dealers to find service tickets showing sales from $5 to $35. The company's general experience has shown that, where its dealer checks with the motorist the various items shown on the ticket, the average unit sale is in excess of

ORIGINAL CONEWANGO GENUINE H-M OIL TRADE MARK REG. GROSS TARE NET

ORIGINAL CONEWANGO GENUINE L-M OIL TRADE MARK REG. GROSS TARE NET

The Accepted Standards of Pennsylvania Bright Stock Excellence Since 1900

H-M and L-M Oils Are Made Solely By

THE CONEWANGO REFINING CO.
Warren, Pa.

$4. This mainly consists of petroleum products, accessory items, or regular services performed at the station.

In a recent issue of the Diamond Guaranteed Lubrication Bulletin, the advantages of the service ticket are pointed out as follows:

"Too many dealers are missing profits to which they are rightfully entitled. Many presume that they can get along without a job ticket, thinking that they can remember the many services needed on a car. This, of course, is a fallacy, and even if the dealer could remember the items, he would become embarrassed in reciting them to the customer from memory. The Diamond Dealer's Service Ticket saves the dealer this embarrassment. Further, it makes the customer feel he is doing business with a business man, as when the items on the ticket are checked off, it is done in a business-like manner. Moreover, when the ticket is returned to the customer he gets an itemized statement of the services performed as well as a written guarantee of good workmanship, which, of course, satisfies and pleases him."

The Mid-Continent company points out that the time is fast approaching when customers who patronize stations will demand more definite information as to what services the station performs and what their cars need than they have asked for in the past. It is here that the company's lubrication plan and service ticket fit into the picture. It is explained to the customer as the system which the station uses to accurately and regularly check the condition of the car.

Mid-Continent passes this timely word of advice along to its dealers — "Display more interest in your business by interesting yourself more in your customers". Not a bad thought, and lubrication service can be made the foundation of such a policy.

New Patents

The following patents of interest to readers of this journal recently were issued from the U. S. Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trademark attorney, 511 Eleventh Street, N. W., Washington, D. C., at the rate of 25c each. State number of patent and name of inventor when ordering.

August 23, 1938

REFINING

Process for treating hydrocarbon distillates—Reginald K. Stratford, Sarnia, Ont., Canada, assignor to Standard Oil Development Co. Filed Aug. 10, 1934. No. 2,127,654.

Dewaxing system—Vanderveer Voorhees, Hammond, Ind., assignor to Standard Oil Co. (Ind.) Filed June 30, 1934. No. 2,127,708.

Process for manufacturing lubricating oils—Egon Eichwald, Amsterdam, Netherlands, assignor to Shell Development Co. Filed June 15, 1936. No. 2,127,811.

Process for breaking petroleum emulsions—Melvin De Groote, University City, Mo., assignor to Tret-O-Lite Co. Filed Sept. 25, 1937. No. 2,127,905.

Process of treating hydrocarbon oils—Harry E. Drennan, Whittenburg, Tex., assignor to Phillips Petroleum Co., Filed July 25, 1936. No. 2,127,953.

Solvent refining oil—Waldersee B. Hendrey, Beacon, N. Y., assignor to Texas Co. Filed Oct. 17, 1936. No. 2,128,029.

Polymerization of gaseous olefins—Albert E. Dunstan, London, England, assignor to Anglo-Iranian Oil Co. Ltd. Filed June 5, 1936. No. 2,128,126.

MISCELLANEOUS

Manufacture of nitrogen base salts of acid alkyl esters—Anton J. Tulleners, Amsterdam, Netherlands, assignor to Shell Development Co. Filed June 20, 1936. No. 2,127,495.

Lubricating grease—Frederick A. Webster, Jr., Richmond, Calif., assignor to Standard Oil Co. (Calif.) Filed May 21, 1934. No. 2,127,497.

Method of enhancing safety of liquid fuel (during storage)—Peter Schlumbohn, New York, N. Y. Filed Oct. 12, 1935. No. 2,127,536.

High tensile strength wax—Elmer W. Adams, Hammond, Ind., and Frederick H. MacLaren, Calumey City, Ill., assignor to Standard Oil Co. (Ind.) Filed Apr. 19, 1934.

Liquid dispensing device (gasoline nozzle)—George B. Davis, Jr., Washington, D. C. Filed June 22, 1937. No. 2,127,860.

Motor fuel stabilization—Richard G. Clarkson, Wilmington, Del., and Claude G. Wolff, Penns Grove, N. J., assignors to E. I. du Pont de Nemours & Co. Filed Jan. 17, 1936. No. 2,128,075.

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When Fleet-Wing is your brand, you always have an assured source of supply—good times or slow. Fleet-Wing's only outlets are independent jobbers who market Fleet-Wing products, with Fleet-Wing as their own brand in their own territories. Fleet-Wing is duty-bound to take care of its jobbers' needs.

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FLEET-WING CORPORATION, CLEVELAND, OHIO

Fleet-Wing Golden Gasoline—Fleet-Wing Ethyl—Fleet-Wing Certified Motor Oil—Fleet-Wing 100% Pennsylvania Motor Oil—Fleet-Wing Specialized Automotive Lubricants—Fleet-Wing Fuel Oil—Fleet-Wing Farm and Tractor Oils and Greases—Fleet-Wing Specialties.

Markets

Mid-Continent

TULSA, Sept. 6. — Refiners reported pre-holiday buying of gasoline by jobbers in the Mid-Continent was disappointing last week as unsettled retail and crude oil markets kept the market in a turmoil. Reduced tank car prices, and a tendency on the part of jobbers to delay purchases as much as possible, increased the volume of gasoline available, and competition was keen for what little business there was, refiners said.

With refined gasoline movement slow, refiner use of natural gasoline dropped noticeably and by the end of the week supplies were freely offered, according to reports.

Higher prices for Pennsylvania lubes was said to have reacted favorably on Mid-Continent and South Texas oils. Prices were steadier, refiners said.

Pennsylvania

CLEVELAND, Sept. 6. — Pennsylvania refiners reported no adverse reaction in refined oil prices to a 12-cent reduction in crude prices made by leading purchasers Sept. 1. Such price changes as were reported, in fact, were upward.

Demand for lubricating oils against contracts continued active with neutral oils particularly scarce and tight, refiners said. No changes were reported in lube prices.

U. S. Motor gasoline, 45 w.w. kerosine and 36-40 fuel oil were priced higher in the upper field when one refiner who had been quoting the low of the market reported advances of 0.125 to 0.25 cent in his quotations. Lower field quotations for light products were unchanged, according to reports.

Eastern

NEW YORK, Sept. 6. — With the weather man predicting good motoring weather over the Labor Day holiday, movement of gasoline picked up somewhat at eastern seaboard terminals early the past week, according to reports of sellers.

Sellers generally hoped that buying in anticipation of movement over the holiday, and replacement buying after Labor Day would do much to relieve what several admitted is an overburdened supply condition at many terminals along the East Coast.

Prices, meanwhile, continued easy at most points. This was said to be particularly true in the New York harbor market. Some shading of 6.25 cents for high octane in barges at New York was heard, but sellers insisted they were not cutting this price.

N. P. N. Refinery Index

The Refinery Index shown below is the calculated average return from refining a barrel of 36 gravity Mid-Continent crude into its various principal products at the current price of crude oil. The index indicates the following margins in cents per barrel between cost of crude and current selling price of products.

A new basis for the computation of the N.P.N. Refinery is employed in arriving at the accompanying index figures. This basis takes into account the gradually increasing yields of the more valuable products since 1934, the year on which previous indexes were based. A comparison of the new indexes with the old is afforded by a table on page 26, NATIONAL PETROLEUM NEWS, July 13, 1938.

Date	Margin
Sept. 1	39.0
Month ago	45.7
Year ago	59.5

Gulf

NEW YORK, Sept. 6. — Reduction of 10 cents in East Texas crude prices was not reflected in any changed position of products in the refined oil market at the Gulf, according to reports.

While the cut in crude was about the only development worthy of mention last week, movement from the Gulf, both foreign and to a lesser degree, domestically, continued slow.

Foreign inquiries, particularly, have been absent, only two firm inquiries having been reported recently. Occasional "market feelers" have been reported from time to time, but they have resulted in few actual orders.

Gasoline continued to be reported easy with gas oil relatively well held.

N.P.N. Gasoline Index

	Dealer T.w. Cents per	Tank Car gal.
Sept. 6	10.06	5.94
Month ago	10.24	6.20
Year ago	10.70	6.73

Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is a weighted average of 12 wholesale markets for regular-grade gasoline.

Mid-Western

CHICAGO, Sept. 6. — Offerings of low octane gasoline were reported plentiful by most tank car marketers the past week as movement of this grade from the Mid-Continent was augmented by shipments from Michigan and the southern Illinois fields. Contract shipments of 70-72 octane were reported heavy throughout the week in anticipation of Labor Day needs. Some marketers, whose quotations had been at the high of the market, reported reducing their spot quotations on this grade 0.125 cent.

All grades of Michigan gasoline were in good demand and inventories were low, refiners said. No price changes were reported.

Kerosine movement in the Mid-Western area was reported slightly better.

California

LOS ANGELES, Sept. 3. — West coast suppliers interested in the offshore trade made bids on about five cargoes of fuel oil to be picked up by Japanese Navy tankers at California ports during November and December. The previous purchase of this product, which is somewhat better quality than Bunker "C", was made at about 64 cents a barrel. Observers believe current bids to be opened next week, will show prices ranging rather higher than this figure.

Otherwise the local cargo market was featureless. Suppliers active in meeting bunker oil demand, whenever there is any, reported spot quotations ranged in the neighborhood of 70 cents, notwithstanding a price of 90 cents posted by major suppliers.

Domestic markets reflected the inability of small independent refiners to hold a rack price on "no-brand" products at 7 cents in the face of a 6.75-cent quotation by one large independent.

Wax

NEW YORK, Sept. 6. — Demand for wax was reported fair in the coastal markets last week. Prices generally were unchanged, traders said.

Some suppliers said they were asking 2.35 cents a pound for white crude scale and had made occasional sales at this price while others said they were offering it at 2.25 cents.

Fuel Oil

CHICAGO, Sept. 6. — Increased interest in light fuels was reported by most marketers and a considerable number of contracts covering shipments over the winter have already been signed, they said. Nos. 2 and 3 burner fuels continued tight in the Mid-Continent field, and higher prices were quoted by one marketer.

Light fuel inventories were also reported low by most Michigan refiners.

(*Continued on page* 48)

REFINERY TANK CAR MARKETS

All prices on this page are publisher's opinion of open market quotations or sales, for spot shipment (10 to 15 days). Prices in cents per gallon except heavy fuel oils in dollars per barrel of 42 gallons, tank car lots, f.o.b. refineries in districts designated, except where otherwise noted. Inter-refinery and export prices not included, unless so stated in the respective markets. Federal, state or municipal taxes not included. Prices quoted apply on products made from legally produced crude. Unless otherwise noted, gasoline octane ratings are determined by C.F.R. Motor method, A.S.T.M. D-357-33T; and lubricating oil specifications determined according to A.S.T.M. methods, unless otherwise noted.

Gasoline

Prices Effective	Sept. 6	Aug. 29
OKLAHOMA		
U. S. Motor: (Octane L-3)		
62 oct. & below	4.50 – 5.00	4.625– 5.00
63-66 oct.	4.75 – 5.125	4.875– 5.125
67-69 oct.	5.00 – 5.50	5.125– 5.50
70-72 oct.	5.25 – 5.75	5.375– 5.75
60-62, 400 e.p.	4.50 – 4.625	4.625– 4.75
WESTERN PENNA.		
Bradford-Warren:		
Motor gasoline:		
U. S. Motor (58-62°)	(e)5.25	(h)5.25 –5.375
Min. 65 oct.	7.00 – 7.25	(h)7.00 –7.25
Min. 70 oct.	(e)7.50	(e)7.50
"Q" gasoline	(g)7.25	(g)7.25
Other districts:		
Motor gasoline:		
U. S. Motor (58-62°)	4.75 – 5.00	4.75 – 5.00
Min. 65 oct.	(h) 6.75 –7.00	6.75 – 7.00
"Q" gasoline	(g) 7.00 –7.25	(g)7.00 –7.25
CENTRAL MICHIGAN (a)		
Str.-Run Gasoline	(c)5.00 –5.375	(c) 5.00 –5.375
U. S. Motor: (Octane L-3)		
67-69 octane	(e)7.50	(e)7.50
70-72 octane	8.00 – 8.125	8.00 – 8.125
CALIFORNIA (3c tax to be added if used in state)		
U. S. Motor:		
54-58, for instate shipment	6.75 – 9.25	6.75 – 9.25
54-58, for outside state shipment	7.00 – 9.00	7.00 – 9.00
58-61, 375-400 e.p., 65 oct. & above	7.75 – 9.75	7.75 – 9.75
N. TEX. (b)		
U. S. Motor: (Octane L-3)		
62 oct. & below	4.50 – 5.00	4.50 – 5.00
63-66 oct.	4.75 – 5.50	4.75 – 5.50
67-69 oct.	5.00 – 5.50	5.00 – 5.625
70-72 oct.	5.375– 5.625	5.375– 5.75
60-62, 400 e.p.	4.50 – 4.625	4.50 – 4.75
KANSAS (For Kansas destinations only)		
U. S. Motor: (Octane L-3)		
62 oct. & below	4.625– 5.125	5.00 – 5.25
70-72 oct.	5.50 – 5.875	5.75 – 6.00
W. TEX. (b)		
U. S. Motor: (Octane L-3)		
62 oct. & below	4.625– 5.00	4.75 – 5.00
63-66 oct.	4.875– 5.25	5.00 – 5.25
67-69 oct.	5.25 – 5.625	5.375– 5.625
70-72 oct.	5.50 – 5.875	5.625– 5.875
E. TEX.		
60-62, 400 e.p.	4.50 – 4.625	4.50 – 4.625
N. LA. (For shipment to La. & Ark.)		
U. S. Motor: (Octane L-3)		
62 oct. & below	4.625– 4.75	4.75
63-66 oct.	(e)5.00	(e)5.125
67-69 oct.	(e)5.125	(e)5.25
70-72 oct.	5.625– 5.75	5.75
ARKANSAS (F.o.b. Ark. plant of one refiner, for shipment to Ark. & La.)		
U. S. Motor: (Octane L-3)		
62 octane & below	4.875	5.00
67-69 oct.	5.50	5.50
OHIO (Quotations of S. O. Ohio. Delivered anywhere in Ohio).		
U. S. Motor	8.00	8.125
Above 65 oct.	8.25	8.375

Natural Gasoline

(Prices to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

F.O.B. GROUP 3		
Grade 26-70	3.25	3.25
F.O.B. BRECKENRIDGE		
Grade 26-70	3.25	3.25
CALIFORNIA (F.o.b. plants in Los Angeles basin)		
75-85, 350-375 e.p. for blending	6.50 – 7.00	6.50 – 7.00

Kerosine

Prices Effective	Sept. 6	Aug. 29
WESTERN PENNA.		
Bradford-Warren:		
45 w.w.	(h) 5.125–5.25	(h)5.00 –5.25
46 w.w.	(e) 5.25 –5.375	(e)5.25 –5.375
Other districts:		
45 w.w.	4.875– 5.00	4.875– 5.00
46 w.w.	(h)5.00	(h)5.00
47 w.w.	5.125– 5.25	5.125– 5.25
CENTRAL MICHIGAN (a)		
47-49 w.w.	5.00 – 5.30	5.00 – 5.30
OKLAHOMA		
41-43 w.w.	4.00 – 4.25	4.00 – 4.25
42-44 w.w.	4.25 – 4.625	4.25 – 4.625
KANSAS (For Kansas destinations only).		
41-43 w.w.	4.625	4.625
42-44 w.w.	4.625– 5.00	4.625– 5.00
N. TEX. (b)		
41-43 w.w.	4.25 – 4.50	4.25 – 4.50
N. LA. (For shipment to La. and Ark.)		
41-43 w.w.	4.00 – 4.50	4.125– 4.50
ARK. (F.o.b. Ark. plant of one refiner, for shipment to Ark. and La.)		
41-43 w.w.	4.625	4.625
CALIFORNIA		
40-43 w.w.	5.00 – 7.00	5.00 – 7.00

Gas *and* Fuel Oils

WESTERN PENNA.		
Bradford-Warren:		
36-40	(h)4.25	(h)4.00 –4.125
Other districts: (Excluding Pittsburgh District Prices).		
36-40	3.75 – 4.00	3.75 –4.00
CENTRAL MICHIGAN (a)		
P.W. Distillate	4.50 – 5.00	4.50 – 4.75
No. 3 gas oil, Str.	4.25 – 4.50	4.25 – 4.50
U.G.I. gas oil	4.00 – 4.25	4.00 – 4.25
Fuel Oils (Vis. at 100):		
500-700 Vis.	2.375– 2.50	2.375– 2.50
300-500 Vis.	2.50 – 2.75	2.50 – 2.75
100-300 Vis.	2.625– 3.25	2.625– 3.25
OKLAHOMA		
No. 1 prime white	3.75 – 4.00	3.75 – 4.00
No. 2 straw	3.50 – 3.75	3.50 – 3.625
U. G. I. gas oil	(e)3.25	(e)3.25
28-30 zero fuel	3.25 – 3.50	3.25 – 3.50
24-26 fuel	(e)$0.925	(e)$0.925
18-22 fuel	(f)	(f)
14-16 fuel	(e)$0.70	(e)$0.70
KANSAS (For Kans. destinations only).		
No. 1 p.w. fuel oil	4.125	4.125
10-14 fuel oil	$0.45 –$0.80	$0.45 –$0.80
N. TEX. (b)		
No. 1 Prime white	(e)4.00	(e)4.00
N. LA. (For shipment to La. and Ark.)		
20-24 fuel	(e) $1.05–$1.10	(e)$1.10–$1.15
16-20 fuel	(e) $0.85–$0.90	(e)$0.90–$0.95
10-14 fuel	(e) $0.75–$0.80	(e)$0.80–$0.85
ARK. (F.o.b. Ark. plant of one refiner, for shipment to Ark. and La.)		
No. 2 fuel	3.625	3.625
28-30 gas oil, zero	3.375	3.375
CALIFORNIA		
San Joaquin Valley:		
Heavy fuel	$0.55 –$0.75	$0.60 –$0.75
Light fuel	$0.70 –$0.85	$0.75 –$0.85
Diesel fuel (per gal.)	3.50 – 4.00	3.50 – 4.00
Stove dist. (per gal.)	3.75 – 6.00	3.75 – 6.00
Los Angeles:		
Heavy fuel	$0.45 –$0.90	$0.50 –$0.90
Light fuel	$0.60 –$1.00	$0.65 –$1.00
Diesel fuel (per gal.)	2.50 – 4.00	2.50 – 4.00
Stove dist. (per gal.)	2.75 – 6.00	2.75 – 6.00
San Francisco:		
Heavy fuel	$0.95	$0.95
Light fuel	$1.05	$1.05
Diesel fuel (per gal.)	4.50	4.50
Stove dist. (per gal.)	6.50	6.50

Note: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

Neutral Oils

Prices Effective	Sept. 6	Aug. 29
WESTERN PENNA. (Refiners report no open spot market sales being made to jobbers and give following as their quotations only.)		
Viscous Neutrals No. 3 col. (*Viscosity at 70° F.*)		
200 Vis. (180 at 100°)	420-425 fl.	
0 p.t.	18.00	18.00
10 p.t.	17.00	17.00
15 p.t.	16.50	16.50
25 p.t.	15.00	15.00 –16.00
150 Vis. (143 at 100)	400-405 fl.	
0 p.t.	17.00	17.00
10 p.t.	16.00	16.00
15 p.t.	15.50	15.50
25 p.t.	14.00	14.00
SOUTH TEXAS		
Vis. Color		
Pale Oils: (*Vis. at 100°F.*)		
100 No. 1½-2½	4.75 – 5.25	4.75 – 5.25
200 No. 2-3	6.25	6.25
300 No. 2-3	6.75	6.75
500 No. 2½-3½	7.75	7.75
750 No. 3-4	8.25	8.25
1200 No. 3-4	8.75	8.75
2000 No. 4	9.00 – 9.25	9.00 – 9.25
Red Oils:		
200 No. 5-6	6.25	6.25
300 No. 5-6	6.75	6.75
500 No. 5-6	7.75	7.75
750 No. 5-6	8.25	8.25
1200 No. 5-6	8.75	8.75
2000 No. 5-6	9.00 – 9.25	9.00 – 9.25

Note: Red oil prices cover oils with green cast; blue cast red oils are slightly lower in some cases.

MID-CONTINENT (Vis. at 100° F.; F.o.b. Tulsa basis).

Pale Oils: (0 to 10 P.P.)		
Vis. Color		
60-85—No. 2	5.50	5.50
86-110—No. 2	6.00	6.00
150—No. 3	9.00	9.00
180—No. 3	10.00	10.00
200—No. 3	10.50	10.50
250—No. 3	11.50	11.50
280—No. 3	12.50	12.50
300—No. 3	13.00	13.00
Red Oils:		
180—No. 5	(e)9.00	(e)9.00
200—No. 5	9.50 –10.00	9.50 –10.00
280—No. 5	11.50 –11.75	11.50 –11.75
300—No. 5	(e)11.75	(e)11.75

Note: The following oils, of 15 to 25 p.p., are generally quoted these amounts under 0-10 p.p.; viscous oils, 0.5c; non-viscous, 0.25c. Viscous oils (150-300 vis.), No. 4 color, generally are quoted 0.5c above No. 5 color oils.

CHICAGO (Vis. at 100° F.)

Pale Oils 0 to 10 p.p.:		
Vis. Color		
60-85—No. 2	7.25	7.25
86-110—No. 2	7.75	7.75
150—No. 3	10.00	10.00
180—No. 3	11.00	11.00
200— .3	11.50	11.50
250—No. 3	12.50	12.50
Red Oils:		
180—No. 5	10.00	10.00
200 –No. 5	10.50	10.50
250—No. 5	11.50	11.50
280—No. 5	12.50	12.50
300—No. 5	12.75	12.75

Note: Viscous oils, 15 to 30 p.p. are quoted 0.5c lower; 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower. To obtain delivered prices in Chicago, add 0.25c per gal.

Cylinder Stocks

MID-CONTINENT (F.o.b. Tulsa basis)

Bright Stocks:		
100-200 Vis. at 210 °D.	(e)19.00	(e)19.00
150-160 Vis. at 210°D:		
0 to 10 p.p.	14.25 –16.00	14.25 –16.00
10 to 25 p.p.	13.50 –15.50	13.50 –15.50
25 to 40 p.p.	13.50 –15.00	13.50 –15.00
150-160 vis. at 210° E.	12.50 –15.00	12.50 –15.00

(a) Prices f.o.b. Central Michigan refinery group basis, for shipment within Mich. Shipments may originate at plants outside Central group. (b) For shipment to Texas and New Mexico destinations; Group 3 prices quoted on northern shipments. (c) Excluding Detroit shipment. (d) Nominal. (e) One refiner quoting. (f) No quotations reported. (g) To resellers holding licenses. (h) Two refiners quoting.

REFINERY TANK CAR MARKETS

All prices on this page are publisher's opinion of open market quotations or sales, for spot shipment (10 to 15 days) unless otherwise stated. Prices in cents per gallon, except heavy fuel oils in dollars per barrel of 42 gallons, wax and petrolatums in cents per pound in barrels, tank car lots, f.o.b. refineries in districts designated, except where otherwise noted. Inter-refinery and export prices not included unless so stated in the respective markets. Federal, state or municipal taxes not included. Prices quoted apply on products made from legally produced crude. Unless otherwise noted, gasoline octane ratings are determined by C.F.R. Motor method, A.S.T.M. D-357-33T; and lubricating oil specifications determined according to A.S.T.M. methods, unless otherwise noted.

Cylinder Stocks (cont'd)

Prices Effective	Sept. 6	Aug. 29
Mid-Continent (cont'd)		
120 Vis. at 210° D		
0 to 10 p.p.	14.50 -15.125	14.50 -15.125
25 to 40 p.p.	(e)14.25	(e)14.25
600 S.R. Dark Green	5.00 – 7.50	5.00 – 7.50
600 S.R. Olive Green	6.50 – 7.50	6.50 – 7.50
631 S.R.	(e)12.50	(e)12.50
Black Oil	3.50 – 4.00	3.50 – 4.00
CHICAGO (Viscosity at 210°)		
Unfiltered Steam Refined:		
140	9.00	9.00
160	10.00	10.00
200	11.00	11.00
Bright stocks, 160 vis. at 210. No. 8 color:		
0 to 10 p.p.	15.75	15.75
15 to 25 p.p.	14.75	14.75
30 to 40 p.p.	14.25	14.25
E filtered Cyl. Stock	13.50	13.50

Note: To obtain prices delivered in Chicago, add 0.25c per gal.

Prices Effective	Sept. 6	Aug. 29
WESTERN PENNA. (Refiners report no open spot market sales being made to jobbers and give following as their quotations only.)		
600 S.R. filterable	8.00 – 8.50	8.00 – 8.50
650 S.R.	10.00 –11.50	10.00 –11.50
600 fl.	10.50 –12.50	10.50 –12.50
630 fl.	13.00 –14.00	13.00 –14.00
Bright stock, 145-155 vis. at 210°, 540-550 flash, No. 8 color:		
10 p.t.	17.00	16.00 –17.00
15 p.t.	16.00	16.00
25 p.t.	14.00 –14.50	14.00 –14.50

Petrolatums

WESTERN PENNA. (In bbls., carloads; in tank cars, 0.5c less)		
Snow White	6.125	6.125
Lily White	5.125	5.125
Cream White	4.125	4.125
Light Amber	2.50 – 2.625	2.50 – 2.625
Amber	2.25 – 2.375	2.25 – 2.375
Red	2.00	2.00

Wax

Prices Effective	Sept. 6	Aug. 29
WESTERN PENNA. (Refiners report no open spot market sales being made to jobbers and give following as their quotations only. In bbls., carloads, New York)		
122-124 A.m.p., w.c. scale	(e)2.40	(e)2.40
124-126 A.m.p., w.c. scale	2.35 – 2.45	2.35 – 2.40
133-135 A.m.p., w.c. scale	(b)3.625	(b)3.50
OKLAHOMA (In bbls. or burlap bags, carloads)		
124-126 A.m.p., w.c. scale	2.35	2.35
CHICAGO (In bags, carload lots. Melting points are E.M.P. (A.S.T.M.) methods; add 3° F. to convert into A.m.p.)		
Fully refined:		
122-124	4.00	4.00
125-127	(d)4.10	(d)4.10
127-129	(d)4.45	(d)4.45
130-132	(d)4.75	(d)4.75
132-134	(d)5.00	(d)5.00
135-137	(d)5.75	(d)5.75

(a) Nominal. (b) Only one refiner quoting. (c) No price reported. (d) Same prices quoted in bags or slabs loose. (e) Two refiners quoting.

MID-WESTERN TANK CAR MARKET

(Prices group 3 basis; origin of shipments unknown)

Gasoline

Prices Effective	Sept. 6	Aug. 29
U. S. Motor: (Octane L-3)		
62 oct. and below	4.00 – 4.75	4.25 – 4.875
63-66 oct.	4.375– 4.875	4.50 – 5.125
67-69 oct.	4.625– 5.25	4.625– 5.25
70-72 oct.	4.875– 5.375	5.00 – 5.50

Kerosine

41-43 w.w.	3.50 – 4.25	3.50 – 4.25
42-44 w.w.	3.625– 4.375	3.625– 4.375

(a) Nominal.

Fuel and Gas Oils

Prices Effective	Sept. 6	Aug. 29
No. 1 p.w.	3.625– 3.875	3.50 – 4.00
No. 1 straw	3.50 – 3.75	3.50 – 3.75
No. 2 straw	3.50 – 3.625	3.375– 3.75
No. 3	3.25 – 3.375	3.25 – 3.375
No. 5	(a) $0.60–$0.70	(a) $0.60–$0.70
No. 6	(a) $0.35–$0.50	(a) $0.35–$0.50
U. G. I. gas oil	(a) 2.875–3.125	(a) 2.875–3.125
Range oil	3.625– 4.125	3.625– 4.125

Naphtha and Solvent

Stoddard solvent	5.875	5.875
Cleaners' naphtha	6.375	6.375
V. M. & P. naphtha	6.375	6.375
Mineral spirits	5.375	5.375
Rubber solvent	6.375	6.375
Lacquer diluent	7.375	7.375

DAILY GASOLINE PRICES

Daily range of gasoline prices as reported in PLATT'S OILGRAM (Week Ended Sept. 2, 1938)

U. S. Motor, (Octane Number determined according to L-3 Method in Okla., Texas and Mid-Western Districts):	Aug. 29	Aug. 30	Aug. 31	Sept. 1	Sept. 2
62 octane and below:					
Oklahoma	4.625– 5.00	4.50 – 5.00	4.50 – 5.00	4.50 – 5.00	4.50 – 5.00
(b) North Texas	4.50 – 5.00	4.50 – 5.00	4.50 – 5.00	4.50 – 5.00	4.50 – 5.00
West Texas	4.75 – 5.00	4.625– 5.00	4.625– 5.00	4.625– 5.00	4.625– 5.00
Mid-Western (Group 3 basis)	4.25 – 4.875	4.125– 4.875	4.125– 4.75	4.125– 4.75	4.00 – 4.75
63-66 octane:					
Oklahoma	4.875– 5.125	4.75 – 5.125	4.75 – 5.125	4.75 – 5.125	4.75 – 5.125
(b)North Texas	4.75 – 5.50	4.75 – 5.50	4.75 – 5.50	4.75 – 5.50	4.75 – 5.50
West Texas	5.00 – 5.25	4.875– 5.25	4.875– 5.25	4.875– 5.25	4.875– 5.25
Mid-Western (Group 3 basis)	4.50 – 5.125	4.375– 5.125	4.375– 4.875	4.375– 4.875	4.375– 4.875
67-69 octane:					
Oklahoma	5.125– 5.50	5.00 – 5.375	5.00 – 5.375	5.00 – 5.375	5.00 – 5.375
(b)North Texas	5.00 – 5.625	5.00 – 5.625	5.00 – 5.625	5.00 – 5.625	5.00 – 5.625
West Texas	5.375– 5.625	5.25 – 5.625	5.25 – 5.625	5.25 – 5.625	5.25 – 5.625
Mid-Western (Group 3 basis)	4.625– 5.25	4.625– 5.25	4.625– 5.25	4.625– 5.25	4.625– 5.25
70-72 octane:					
Oklahoma	5.375– 5.75	5.25 – 5.75	5.25 – 5.75	5.25 – 5.75	5.25 – 5.75
(b)North Texas	5.375– 5.75	5.375– 5.75	5.375– 5.75	5.375– 5.75	5.375– 5.75
West Texas	5.625– 5.875	5.50 – 5.875	5.50 – 5.875	5.50 – 5.875	5.50 – 5.875
Mid-Western (Group 3 basis)	5.00 – 5.50	4.875– 5.50	4.875– 5.50	4.875– 5.50	4.875– 5.50
Motor Gasoline, 60-64 octane:					
New York harbor	(a) 6.25– 6.75	(a) 6.25 –6.75	(a) 6.25 –6.75	(a) 6.25 –6.75	(a) 6.25 –6.75
Philadelphia district	(a) 6.25 –6.50	(a) 6.25 –6.50	(a) 6.25 –6.50	(a) 6.25 –6.50	(a) 6.25 –6.50
Baltimore district	(a) 6.25 –6.50	(a) 6.25 –6.50	(a) 6.25 –6.50	(a) 6.25 –6.50	(a) 6.25 –6.50
Motor Gasoline, 65 octane & above:					
New York harbor	(a) 6.50 –7.00	(a) 6.50 –7.00	(a) 6.50 –7.00	(a) 6.50 –7.00	(a) 6.50 –7.00
Philadelphia district	(a) 6.50 –6.75	(a) 6.50 –6.75	(a) 6.50 –6.75	(a) 6.50 –6.75	(a) 6.50 –6.75
Baltimore district	(a) 6.50 –6.75	(a) 6.50 –6.75	(a) 6.50 –6.75	(a) 6.50 –6.75	(a) 6.50 –6.75
U. S. Motor, 58-62°:					
Bradford-Warren (Western Penna.)	(e) 5.25 –5.375	(e) 5.25 –5.375	(e)5.25	(e)5.25	(e)5.25
Other districts (Western Penna.)	4.75 – 5.00	4.75 – 5.00	4.75 – 5.00	4.75 – 5.00	4.75 – 5.00
Motor Gasoline, Min. 65 octane:					
Bradford-Warren (Western Penna.)	7.00 – 7.25	7.00 – 7.25	7.00 – 7.25	7.00 – 7.25	7.00 – 7.25
Other districts (Western Penna.)	6.75 – 7.00	6.75 – 7.00	6.75 – 7.00	(e) 6.75 –7.00	(e) 6.75 –7.00
Motor Gasoline, Min. 70 octane:					
Bradford-Warren (Western Penna.)	(e)7.50	(e)7.50	(e)7.50	(e)7.50	(e)7.50
"Q" Gasoline:					
Bradford-Warren (Western Penna.)	(d)7.25	(d)7.25	(d)7.25	(d)7.25	(d)7.25
Other Districts (Western Penna.)	(d) 7.00 –7.25	(d) 7.00 –7.25	(d) 7.00 –7.25	(d) 7.00 –7.25	(d) 7.00 –7.25

(a) Nominal. (b) For shipment to Texas and New Mexico destinations: Group 3 prices are quoted on northern shipment. (c) One refiner quoting. (d) To resellers holding licenses. (e) Two refiners quoting.

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GENERAL OFFICES - - - FINDLAY, OHIO

ROBINSON, ILLINOIS TULSA, OKLAHOMA FT. WORTH, TEXAS

MARATHON PRODUCTS BEST IN THE LONG RUN LINCO

TANK WAGON MARKETS

Tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes, where levied, are indicated in footnotes. Discounts to various classes of buyers also are shown in footnotes These prices in effect Sept. 5, 1938, as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

S. O. New Jersey

Esso Ine

(Regular Grade)

	Consumer Tank Car	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
*Atlantic City, N. J.	7.4	9.4	4	8
*Newark, N. J.	7.4	9.4	4	8
Annapolis, Md.	8.35	9.85	5	9.5
Baltimore, Md.	7.75	9.25	5	9
Cumberland, Md.	9.15	11.65	5	10
Washington, D. C.	8	9.5	3	9.5
Danville, Va.	8.45	10.95	6	12.9
Norfolk, Va.	7.25	9.75	6	11.5
Petersburg, Va.	7.55	10.05	6	11.7
Richmond, Va.	7.55	10.05	6	11.7
Roanoke, Va.	8.75	11.25	6	12.9
Charleston, W. Va.	8.55	11.05	6	12.6
Parkersburg, W. Va.	7.85	9.35	6	11.2
Wheeling, W. Va.	8.85	10.25	6	12.2
Charlotte, N. C.	9.15	11.65	7	12.1
Hickory, N. C.	9.65	12.15	7	12.5
Mt. Airy, N. C.	9.45	11.95	7	12.3
Raleigh, N. C.	8.75	11.25	7	11.6
Salisbury, N. C.	9.25	11.75	7	12.2
Charleston, S. C.	7.75	10.25	7	10.6
Columbia, S. C.	8.75	11.25	7	11.6
Spartanburg, S. C.	9.45	11.95	7	12.4

Discount to undivided dealers: Dealer t.w. price less 0.5c per gal.

*Effective June 21, 1938, S. O. New Jersey posted a minimum retail resale price of 11.9c at these two points.

Note: While the above posted prices continue in New Jersey, dealers will pay a net price of 8.9c per gal. for Esselene. Dealers having pumps marked only Esso, Esselene and "Standard" White gasoline will pay 8.4c per gal. for Esselene.

Price basis to commercial consumers: To contract accounts, purchasing at least one full compartment at a time by hose connection: Effective March 12, 1937, in New Jersey, and March 8 in Maryland, District of Columbia, and in Arlington and Fairfax Counties in Virginia, on yearly purchases: from 2,500 to 100,000 gals., consumer t.w. price at time and place of delivery; 100,000 gals. per year consumer tank car price, plus 0.5c per gal. Generally consumer t.w. price in foregoing states is equivalent of dealer t.w. price, less 0.5c per gal.

Effective May 15, 1937, on Esselene and Esso (by tank wagon) in North and South Carolina, West Virginia and Virginia (except Arlington and Fairfax Counties, which see above), commercial consumers taking deliveries of 50 gals. (West Va. 100 gals.) or more at one time will be billed at the posted consumer t.w. price. Deliveries less than 50 gals. (West Va. 100 gals.) will be billed at 4c per gal. over posted consumer t.w. price. Generally, posted consumer t.w. price will be equivalent to the dealer price less 0.5c per gal.

Kerosine Discount: 1c off t.w. price for 25 gals., or more, under contract thru territory (Baltimore City contract not necessary) except no discount in state of New Jersey.

Socony-Vacuum Oil Co., Inc.

(S. O. New York Division)

Socony Mobilgas

(Regular Grade)

	Consumer Tank Car	"Split" Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Metropolitan N. Y. City: Boroughs of Manhattan, Bronx and Brooklyn (Kings and Queens)	7.5	8.9	*5	8
Borough of Richmond (Staten Is.)	7.5	8.9	*5	8
Albany, N. Y.	7.8	9.8	5	8.5
Binghamton, N. Y.	9	10	5	9
Buffalo, N. Y.	8.4	9.5	5	8
Jamestown, N. Y.	8.1	10.6	5	8.25
Plattsburg, N. Y.	8.3	10.3	5	9.5
Rochester, N. Y.	8.5	10.3	5	8.5
Syracuse, N. Y.	8.1	9.5	5	9
Danbury, Conn.	8.1	10.1	4	9
Hartford, Conn.	7.9	9	4	7
New Haven, Conn.	7.8	9.8	4	7
Bangor, Me.	8.25	10.3	5	9
Portland, Me.	7.75	10	5	8.75
Boston, Mass.	7.50	9	4	8
Concord, N. H.	8.6	10.5	5	9
Lancaster, N. H.	9.7	12	5	10.25
Manchester, N. H.	8.3	10	5	8.5
Providence, R. I.	7.50	9	4	8
Burlington, Vt.	8.4	10.4	5	9.5
Rutland, Vt.	8.6	10.7	5	9

*Plus 2% city sales tax computed at time of each sale.

Discount to undivided dealers: 0.5c less than "split" dealer t.w.

Price basis to commercial consumers: Effective about Nov. 15, 1936 in New York and New England for tank wagon delivery: monthly purchases of 25,000 gals. or over, pay consumer tank car price at point of delivery, plus 0.5c gal.; monthly purchases of 5,000 to 25,000 gals., pay undivided dealer tank wagon price at point of delivery; monthly purchases of less than 5,000 gals., pay divided dealer tank wagon price at point of delivery. Private consumers pay undivided dealer tank wagon price at point of delivery, plus 2c gal.

Atlantic Refining

Atlantic White Flash Gasoline

(Regular Grade)

	Commercial Tank Car	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Philadelphia, Pa.	7	8.25	5	10
Pittsburgh	8	10	5	10.5
Allentown	7.5	9	5	10.5
Erie	8	9.5	5	10
Scranton	7.5	9	5	10.5
Altoona	8	10	5	10.5
Harrisburg	7.5	9	5	10.5
Williamsport	7.5	9	5	10.5
Dover, Del.	...	8.5	5	10.5
Wilmington	...	8.5	5	9.75
Boston, Mass.	...	9	4	8
Springfield, Mass.	...	9.5	4	8
Worcester, Mass.	...	9	4	8.5
Fall River, Mass.	...	8.5	4	8
Hartford, Conn.	...	9	4	7
New Haven, Conn.	...	9.8	4	7
Providence, R. I.	...	9	4	8
Atlantic City, N. J.	...	8.9	4	8
Camden, N. J.	...	8.9	4	8
Trenton, N. J.	...	8.9	4	8
Annapolis, Md.	...	9.85	5	9.5
Baltimore, Md.	...	9.25	5	9
Hagerstown, Md.	...	10.35	5	10
Richmond, Va.	...	10.05	6	11.7
Wilmington, N. C.	...	10.35	7	10.8
Brunswick, Ga.	...	10	7	*11.5
Jacksonville, Fla.	...	9	8	10

*Georgia has kerosine tax of 1c per gal., not included in above price.

Discount to undivided dealers: Dealer t.w. less 0.5c per gal. except in Georgia and Florida, dealer t.w. and undivided dealer price is same.

Price basis to commercial consumers: consumers under contract, in Penna. and Delaware, effective Mar. 11, 1937, on yearly gasoline purchases taking full compartment hose deliveries, using 100,000 gals. or more per year, tank car price plus 0.5c per gal.; consumers taking less than 100,000 gals., undivided dealer price. Consumers under contract and not under contract, taking less than full compartment delivery, and consumers not under contract taking full compartment delivery, get divided dealer price. Consumers taking less than 25 gals., t.w. delivery, get 4c above undivided dealer price.

Discount on kerosine: Effective Oct. 29, 1936, in Pennsylvania and Delaware, 2c per gal. off t.w. price on t.w. deliveries of 25 gals. or more at one time.

S. O. Ohio

Sohio X-70 Gasoline

(Regular Grade)

	Consumer T.W.	†Divided Dlr.	Gasoline Taxes	Kerosine T.W.
Ohio State-wide	11.5	10.5	5	*12
Counties where prices are below statewide:				
Butler, Clark, Clinton, Columbiana, Defiance, Greene, Knox, Montgomery, Pickaway and Preble:	11	10	5	....
Hamilton	11	9.5	5	....
Franklin and Paulding:	10.5	9.5	5	....

Renown Gasoline

(Third Grade)

Ohio State-wide	11	10	5	....
Counties where prices are below statewide:				
Hamilton	11	9.5	5	....
Clark, Columbiana, Defiance, Knox and Pickaway	10.5	9.5	5	....
Franklin and Paulding:	10	9	5	....
Counties where prices are above statewide:				
Clermont, Darke, Miami and Warren:	11.5	10.5	5	....

S. O. Ohio Cont'd

Kerosine Prices

(Off Statewide Level)

Kerosine prices are off statewide level in the following counties:

Allen, Auglaize, Champaign, Columbiana, Darke, Geauga, Greene, Hardin, Logan, Mahoning, Mercer, Preble, Putnam, Shelby, Trumbull and Van Wert *11.5
Paulding *11
Ashtabula *10.5
Fayette, Madison, Pickaway, Portage and Summit *8.5

†This price also to authorized agents, exclusive of 0.5c rental. Discount to undivided dealers: 0.5c less than divided dealer t.w.

*Ohio has kerosine tax of 1c per gal., not included in above prices.

Commercial Tank Wagon Q.D.A. to contract accounts: Effective Oct. 20, 1937, thru Ohio (except in 30 counties), on monthly purchases, off posted consumer t.w. price: 0 to 999 gals., 0.5c; 1,000 to 19,999 gals., 1.5c; 20,000 gals. and over, 2.5c. The 30 counties where Q.D.A. differs from statewide are: Allen, Ashtabula, Auglaize, Butler, Champaign, Cuyahoga, Darke, Defiance, Erie, Fulton, Geauga, Hamilton, Hancock, Hardin, Henry, Highland, Logan, Lorain, Lucas, Mahoning, Mercer, Ottawa, Paulding, Putnam, Sandusky, Scioto, Shelby, Trumbull, Van Wert, Washington, Williams and Wood.

Sales tax: Ohio's 3% sales tax, effective Jan. 27, 1935, is added "where assessable, to regular posted prices," S. O. Ohio says.

On kerosine, prices to resellers and commercial consumers are posted generally at 3c per gal. below consumer t.w. price in any quantity, when such prices are on statewide level.

S. O. Kentucky

Crown Gasoline

(Regular Grade)

	Consumer T.W.	Net Dlr.	Gasoline Taxes	Kerosine T.W.
Covington, Ky.	12	9	6	10.5
Lexington, Ky.	13.5	10.5	6	10.5
Louisville, Ky.	13	10	6	10
Paducah, Ky.	10.5	7.5	6	10
Jackson, Miss.	12.5	9.5	7	*9.5
Vicksburg, Miss.	13	10	7	*9
Birmingham, Ala.	13.5	10.5	*8	10
Mobile, Ala.	12.5	9.5	*9	9
Montgomery, Ala.	12.5	10.5	*9	*9
Atlanta, Ga.	12	9	7	*9
Augusta, Ga.	12.5	9.5	7	*7
Macon, Ga.	12.5	9.5	7	*10.5
Savannah, Ga.	12	9	7	*9
Jacksonville, Fla.	10	7	8	8
Miami, Fla.	12.5	9.5	8	9
Pensacola, Fla.	12	9	*9	10
Tampa, Fla.	10	7	8	8.5

Kyso Gasoline

(Third Grade)

Covington, Ky.	10.5	8	6	....
Lexington, Ky.	12	9.5	6	....
Louisville, Ky.	11.5	9	6	....
Paducah, Ky.	9.5	7	6	....
Jackson, Miss.	10.5	8	7	....
Vicksburg, Miss.	10.5	8	7	....
Birmingham, Ala.	11.5	9	*8	....
Mobile, Ala.	10.5	8	*9	....
Montgomery, Ala.	11.5	9	*9	....
Atlanta, Ga.	8.5	6	7	....
Augusta, Ga.	11	8.5	7	....
Macon, Ga.	11	8.5	7	....
Savannah, Ga.	10.5	8	7	....
Jacksonville, Fla.	9.5	7	8	....
Pensacola, Fla.	10.5	8	*9	....
Tampa, Fla.	9.5	7	8	....

Discounts to all tank wagon consumers: Effective Jan. 4, 1937, thru territory, on Crown gasoline, 3c per gal. below consumer t.w. price; on Kyso, 2.5c below, regardless of quantity purchased, per month

**Taxes*: In the tax column is included these city and county gasoline taxes at the following points: Mobile, 2c city; Birmingham, 1c city; Montgomery 1c city and 1c county; Pensacola, 1c city. Georgia and Montgomery, Ala. have kerosine taxes of 1c per gal., and Mississippi 0.5c, not included in above prices.

Above prices include these inspection fees on both gasoline and kerosine, per gallon, figured on basis of 50 gallons per barrel:
Alabama, 1/40c on gasoline, 1/2c on kerosine; Arkansas, 1/5c per gal. in a single barrel, 1/20c per gal. in bulk; Florida, 1/8c; Illinois, 3/100c; Indiana, 1/5c per gal. in lots up to 25 bbls.; 2/25c per gal. in lots of 25 bbls. or more; Kansas, 1/50c, (3/50c can be charged to meet inspection department expenses); Louisiana, 1/32c; Minnesota, 1/25c; Missouri, 3/100c; Nebraska, 3/100c; Nevada, gasoline, 1/20c; North Carolina, 1/4c; North Dakota, 1/20c; Oklahoma, 2/25c per gal. lots of more than 50 in bbls., 1/5c in lots less than 50 bbls.; South Carolina, 1/8c; South Dakota, 1/10c; Tennessee, 2/5c; and Wisconsin, 3/100c on gasoline, 1/25c on kerosine.
Kerosine inspection fee only: Iowa, 3/50c; Michigan, 1/5c per gal.

TANK WAGON MARKETS

Tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes shown in separate column, include 1c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes, where levied, are indicated in footnotes. Discounts to various classes of buyers also are shown in footnotes. These prices in effect Sept. 5, 1938, as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

S. O. Indiana

Red Crown (*Regular Grade*)
Stanolind (*Third Grade*)

	Red Crown Cons. T.W.	Dealer Prices Red Crown T.W.	Stanolind T.W.	Gasoline Taxes	Kerosine T.W.
Chicago, Ill.	11.6	9.6	6.4	4	10.5
Decatur, Ill.	11.6	10.1	8	4	10.5
Joliet, Ill.	11.6	10.1	8.4	4	10.5
Peoria, Ill.	11.6	10.1	9.6	4	10.5
Quincy, Ill.	11.4	9.9	8.8	4	10.3
Indianapolis, Ind.	12.3	10.8	8.9	5	*10.8
Evansville, Ind.	12.1	10.6	9.1	5	*11
South Bend, Ind.	12.6	11.1	9.2	5	*9
Detroit, Mich.	10.3	8.8	7.5	4	9
Grand Rapids, Mich.	10.8	9.8	9	4	9.7
Saginaw, Mich.	12.3	10.8	9.3	4	9.3
Green Bay, Wis.	12.4	10.9	10.2	5	10.3
Milwaukee, Wis.	11.8	10.3	9.5	5	10.7
La Crosse, Wis.	12	10.5	10	5	10.9
Minneapolis-St. Paul	12	10.5	10	5	10.9
Duluth, Minn.	12.4	10.9	10.4	5	11.3
Mankato, Minn.	12	10.5	10	5	10.9
Des Moines, Ia.	11.4	9.9	7.5	4	*10.3
Davenport, Ia.	11.6	10.1	9.6	4	*10.5
Mason City, Ia.	11.8	10.3	9.8	4	*10.7
St. Louis, Mo.	11.2	9.7	7.5	*4	10.1
Kansas City, Mo.	10.9	9.4	6.9	*4	8.5
St. Joseph, Mo.	10.9	9.4	8.9	*4	9.8
Fargo, N. D.	13.2	11.7	11.2	4	12.1
Minot, N. D.	14.5	13	12.5	4	13.4
Huron, S. D.	12.5	11	10.5	5	11.4
Wichita, Kans.	10.4	6.6	5.5	4	7.8

***Taxes: in the tax column is included these city and state gasoline taxes at following points: Kansas City, St. Joseph and St. Louis, 1c city tax. Kerosine taxes: Indiana has 4c, Iowa 3c per gal. state tax, not included in above prices.**

Discount to commercial consumers: **Effective Jan. 1, 1935, thru territory, except Michigan effective Feb. 1, on purchases per month, discount off t.w. prices; all gasolines, 25 to 1,000 gals., at t.w. price; 1,000 gals., or more, 1.5c off t.w. on Ethyl and Red Crown, and 1c on Stanolind (latter effective June 9, 1937). Minimum delivery is 25 gals.**

S. O. Nebraska

Standard Red Crown Gasoline (*Regular Grade*)

	T.W. Dealer	Gasoline Taxes	Kerosine T.W.
Omaha, Neb.	12	6	10.8
McCook	11.5	6	10
Norfolk	12.4	6	11.2
North Platte	12.4	6	11
Scottsbluff	13.5	6	12.3

Discounts to commercial consumers: for tank wagon deliveries covered only by Standard Commercial Consumer Contract, effective January 1, 1935.

S. O. Louisiana

Essolene (*Regular Grade*)

	Consumer Tank Car	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Little Rock, Ark.	7.75	10.25	7.5	11
Alexandria, La.	7.25	9.75	8	*11.5
Baton Rouge, La.	7.25	9.75	8	* 9.5
New Orleans, La.	7.25	9.75	*10	*11.5
Lake Charles, La.	7.25	9.75	8	*11.5
Shreveport, La.	6	8.5	8	*10
Lafayette, La.	7.5	10	8	*11.5
Bristol, Tenn.	10.5	11	8	14.5
Chattanooga, Tenn.	10	12.5	8	14
Knoxville, Tenn.	10.5	13	8	14.5
Memphis, Tenn.	8.5	11	8	12.5
Nashville, Tenn.	9.5	12	8	13.5

*Taxes: New Orleans gasoline tax includes 7c state, 1c federal, and 2c parish tax. Louisiana has kerosine tax of 1c per gal.; in addition New Orleans has 1c parish tax, none of which are included in above prices.

Price basis to dealers: Undivided dealers get dealer price, less 0.5c.

Price basis to commercial consumers: Effective May 15, 1937, thru territory; commercial consumers taking 50 gals. or more at one time will be billed at posted consumer t.w. price; those taking less than 50 gals. at one time will be billed at 4c per gal. over posted consumer t.w. price. Generally, the posted consumer t.w. price will be equivalent to the dealer price less 0.5c per gal.

Humble Oil & Refining Co.

Humble Motor Fuel (*Regular Grade*)

	*T.W.	S.S.	Gasoline Taxes	Kerosine T.W.
Dallas, Tex.	9	13	5	8
Ft. Worth, Tex.	9	13	5	8
Houston, Tex.	9.5	13.5	5	8
San Antonio, Tex.	9	13	5	8

U. S. Motor Gasoline (*Third Grade*)

	*T.W.	S.S.	Gasoline Taxes
Dallas, Tex.	6	10	5
Ft. Worth, Tex.	6	10	5
Houston, Tex.	7	11.5	5
San Antonio, Tex.	7.5	10.5	5

***Price is t.w. price to all classes of dealers and consumers.**

Continental Oil

Conoco Bronze (*Regular Grade*)
Demand (*Third Grade*)

	—Dealer Prices— Conoco Bronz-e-z	Demand	Gasoline Taxes	Kerosine T.W.
Denver, Colo.	10.5	9.5	5	11.5
Grand Junc., Colo.	14	13	5	15
Pueblo, Colo.	11.5	10.5	5	10.5
Casper, Wyo.	12	11	5	11.5
Cheyenne, Wyo.	8	7	5	13
Billings, Mont.	13	10	6	13
Butte, Mont.	13.5	10.5	6	15.5
Great Falls, Mont.	13	12	6	15.5
Helena, Mont.	14	13	6	15.5
Salt Lake City, Utah	12	10	5	16
Boise, Ida.	15.5	11.5	6	18
Twin Falls, Ida.	15	12.5	6	18
Albuquerque, N. M.	11	10	†6.5	12
Roswell, N. M.	11	8.5	†6.5	10.5
Santa Fe, N. M.	12	9.5	*7	12
Muskogee, Okla.	9.5	7	5	7
Oklahoma City, Okla.	8.5	6.5	5	7
Tulsa, Okla.	7	5	5	7
Ft. Smith, Ark.	9.75	6.75	5	7.5
Little Rock, Ark.	9.75	8.125	7.5	8
Texarkana, Ark.	9	7	5	8

†Includes city tax of 0.5c.
*Includes 1c city tax.

S. O. California

Standard Gasoline (*Regular Grade*)

	T.W.	S.S.	Gasoline Taxes	Kerosine T.W.
San Francisco, Cal.	13.5	14.5	4	11.5
Los Angeles, Cal.	13	14	4	10
Fresno, Cal.	14.5	15.5	4	12.5
Phoenix, Ariz.	15.5	16.5	6	*12.5
Reno, Nev.	15.5	16.5	5	13.5
Portland, Ore.	14	15	6	13.5
Seattle, Wash.	14	15	6	13.5
Spokane, Wash.	17	18	6	16.5
Tacoma, Wash.	14	15	6	13.5

Flight Gasoline (*Third Grade*)

San Francisco, Cal.	12	13	4	....
Los Angeles, Cal.	11.5	12.5	4	....
Fresno, Cal.	13	14	4	....
Reno, Nev.	14	15	5	....
Phoenix, Ariz.	14	15	6	....
Portland, Ore.	12.5	13.5	6	....
Seattle, Wash.	12.5	13.5	6	....
Spokane, Wash.	15.5	16.5	6	....
Tacoma, Wash.	12.5	13.5	6	....

***Arizona has kerosine tax of 5c per gal., not included in above prices.**

Discount to dealers: on gasoline, off t.w. price on Standard Ethyl and Standard Gasoline, to 100% dealers, 3c; to split dealers, 2c; on Flight gasoline, both 100% and split dealers, 2c.

On Stanavo Aviation Gasoline, to all classes of dealers, 3c off t.w.

To commercial consumers: off tank wagon price: on single deliveries of 40 gallons and over. Stanavo Aviation, Standard Ethyl and Standard Gasolines, 3c. Flight Gasoline, 2c per gallon. Tank wagon delivery, less than 40 gals., 1c per gal. above posted t.w. price. Discounts on kerosine: in tank cars, 3c off tank truck price; plant deliveries to jobbers, 2.5c below tank truck price.

Canada

PRICES OF IMPERIAL OIL LTD.
Per Imperial Gallon, which is 1.2 U. S. Gallons

3-Star Imperial Gasoline (*Regular Grade*)

	T.W.	Gasoline Taxes	Kerosine T.W.
Hamilton, Ont.	16	6	17
Toronto, Ont.	16	6	17
Brandon, Man.	21.1	7	22.3
Winnipeg, Man.	20.5	7	20.7
Regina, Sask.	19	7	22
Saskatoon, Sask.	21.3	7	24.8
Edmonton, Alta.	19.5	7	21.5
Calgary, Alta.	16.5	7	19
Vancouver, B. C.	16	7	23
Montreal, Que.	15	6	17.5
St. John, N. B.	14.5	10	18.5
Halifax, N. S.	14.5	10	18.5

Discounts to undivided dealers, 1c off t.w. price, except Maritime Provinces where undivided dealers pay t.w. price. Divided dealers pay t.w. price, thru territory.

Aviation Gasoline

Following are tank car, tank wagon or dealer prices, as indicated, of aviation gasoline in several marketing territories.

S. O. OHIO
Thru Ohio
Esso Aviation

	Consumer T.W.	Gasoline Taxes
74 octane	15.5	5
80 octane	16.5	5
87 octane	17.5	5

Discounts: For delivery on contract to hangar operators and resellers: 2c below consumer posted t.w. price, shown above.

S. O. INDIANA
Stanavo Ethyl Aviation Gasoline
73 Octane Number

Chicago, Ill.	14.9 4
Detroit, Mich.	16.5 4
Milwaukee, Wis.	15.1 5
Minneapolis, Minn.	15.3 5
St. Louis, Mo.	14.5 3
Kansas City, Mo.	14.2 *4
Fargo, N. D.	16.5 4
Huron, S. D.	15.8 5

***Includes 1c city tax.**

HUMBLE OIL & REFINING CO.
Aviation Gasoline

	Tank Car
Baytown, Tex.	8.5

CONTINENTAL OIL CO.
Conoco Special Gasoline

	Dealer	Gasoline Taxes
Denver, Colo.	14.5	5
Cheyenne, Wyo.	15	5
Helena, Mont.	17	6
Salt Lake City, Utah	17.5	5
Albuquerque, N. M.	14	*6.5

***Includes city tax of 0.5c.**

S. O. CALIFORNIA
Stanavo Aviation Gasoline

	T.W.
Phoenix, Ariz.	17.5 6
Los Angeles, Cal.	15 4
San Francisco, Cal.	15.5 4
Reno, Nev.	17.5 5
Portland, Ore.	16 6
Seattle, Wash.	16 6
Spokane, Wash.	19 6

Note: For discounts, etc., see note under Standard and Flight gasoline above.

Naphtha (In Tank Wagon)

S. O. NEW JERSEY

	Posted Tank Wagon Prices Mineral Spirits	V.M.&P.
Newark, N. J.	11.5	15.5
Baltimore, Md.	15.5	....
Washington, D. C.	15	....

Discounts: Buyers taking following quantities, at one time, get these discounts: Newark, 2c per gal. on 200 gals. or more; less than 200 gals., 0.5c higher price. Baltimore 2c off on 25 to 100 gals. and 3c on over 100 gals. Washington, 2c off to contract buyers.

SOCONY-VACUUM OIL CO.

Buffalo, N. Y.	11	12.5
*New York City	9.5	10.5
Rochester, N. Y.	12	12.5
Syracuse, N. Y.	12.5	15
Boston, Mass.	11.5	11.5
Bridgeport, Conn.	11	11.5
Hartford, Conn.	11	11.5
Providence, R. I.	11.5	12.5

***Prices apply to consumers only in quantities over 1,000 gals. annually. For quantities under 1,000 gals. annually, add 0.5c per gal.**

ATLANTIC REFINING CO.

Philadelphia, Pa.	11.5	12.5
Lancaster, Pa.	13	14
Pittsburgh, Pa.	12.5	14.5

Note: Prices for Mineral Spirits also apply to Stoddard Solvent; and prices for V.M.&P. Naphtha apply also to Light Cleaners Naphtha.

S. O. OHIO

	S.R. Solvent	V.M.&P. Naphtha
Thru Ohio	12.5	13.5

Note: V.M.&P. Naphtha prices also apply on Dry Cleaners naphtha and special Varnolene; Varnolene and Sohio Solvent 0.5c below these prices. Discounts to contract consumers, off t.w. price: 300 to 999 gals., 0.5c; 1,000 to 2,499 gals., 0.75c; 2,500 to 4,999 gals., 1c; 5,000 or more gals., 1.5c.

TANK WAGON MARKETS

Tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes, where levied, are indicated in footnotes. Discounts to various classes of buyers also are shown in footnotes. These prices in effect Sept. 5,* **1938,** *as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

S. O. INDIANA

(Prices include state and federal taxes)

	Oleum Spirits	V.M.&P. Naphtha	Stanisol
Chicago, Ill.	16.2	16.5	15.9
Detroit, Mich.	19.2	18.7	19.7
Kansas City, Mo.	13.9	14.9	14.4
St. Louis, Mo.	14.2	15.2	12.9
Milwaukee, Wis.	18.8	19.8	19.3
Minneapolis, Minn.	19	20	17.7

Note: All prices, with exception of Missouri points, include state tax. Prices shown are base prices, before discounts.

Naphtha (In Tank Cars)

In Tank Cars (F. o. b. refinery or seaboard terminal except Ohio, delivered price.)

	V.M.&P. Naphtha	Solvent
Baltimore	10.5	9.5
New York Harbor	10	9
Philadelphia district	10.5	9
Boston	10.5	9.5
Providence	10.5	9.5
Ohio points, delivered	8.875	*8

*This is on rubber solvent.

Note: In Ohio, prices on D.C. naphtha and special. Varnolene are same as V.M.&P.; on Varnolene and Sohio Solvent, prices are 0.5c less than on V.M.&P

Latest Changes

From Aug. 30 to Sept. 5 inclusive. Dates and amounts of changes shown. See table for full current prices.

S. O. Kentucky—Crown Gasoline:
Cut 0.5c, Savannah, Sept. 1.

Kyso Gasoline:
Cut 0.5c, Macon, Aug. 30.
Up 1c, Savannah, Sept. 1.

Kerosine:
Cut 2c, Augusta, Aug. 31.

S. O. Nebraska—Red Crown:
Dealer price up 2c, Norfolk, Aug. 30.

Continental Oil—Kerosine:
Ft. Smith cut 2c, Aug. 30.

Corrections

Notation of amount of change and dates not previously shown in table. Table in this issue is corrected to show these changes.

Atlantic Refining—White Flash Gasoline:
Allentown t. c. and dealer t. w. cut 0.25c, July 1.
Scranton t. c. and dealer cut 0.5c, July 1.
Williamsport t. c. cut 0.5c, dealer cut 1c, July 1.
Wilmington, Del. dealer up 1c, July 9.
Fall River dealer cut 0.5c, June 1.
Hartford dealer cut 0.6c, Aug. 24.
New Haven dealer up 0.3c, June 28.
New Jersey points, dealer price up 0.3c, June 22.
Jacksonville dealer up 0.5c, Aug. 24.

Kerosine:
Brunswick cut 1.5c, July 30.
Jacksonville cut 1c, June 25.

S. O. Kentucky—Crown Gasoline:
Cut 0.5c, Macon, Aug. 12; cut 1c, Aug. 25.
Cut 2.5c, Jacksonville, Aug. 26.
Cut 2.5c, Tampa, Aug. 26.

Kyso Gasoline:
Cut 1.5c, Atlanta, Aug. 27.
Cut 0.5c, Macon, Aug. 12; cut 0.5c, Aug. 25.
Cut 1.5c, Jacksonville, Aug. 26.
Cut 1.5c, Tampa, Aug. 26.

Kerosine:
Cut 1.5c, Montgomery, Aug. 18.
Cut 1c, Augusta, Aug. 18.
Lexington was not cut 0.5c, Aug. 1, as reported on page 44, Aug. 17 issue.
Prices at following points should have been these, effective on dates shown, excluding taxes: Jackson, 9.5c, June 15; Vicksburg, 9c, July 27; Montgomery, 10.5c, July 27; Atlanta, 11c, May 16; Augusta, 10c, July 27; and Macon, 10.5c, July 27. Prices published previous to this issue erroneously included state and city taxes, where effective.

S. O. Indiana—Kerosine:
Cut 0.4c, Indianapolis, Aug. 26.

Continental Oil—Kerosine:
Ft. Smith up 2c, Aug. 22.

S. O. Louisiana—Essolene:
Dealer t. w. cut 1.25c, Bristol, July 8; consumer t. c. cut 0.25c, dealer t. w. cut 1c, July 14.

Heating Oils

Atlantic Refining:
Philadelphia Nos. 2, 3 and 4, cut 1c, May 9.
Allentown No. 1 up 0.25c; Nos. 2, 3 and 4 cut 1c, May 9.
Wilmington No. 1 cut 0.5c, May 20; Nos. 2, 3 and 4, cut 1.5c, May 9.
Springfield No. 1, 2 and 4 cut 1c, May 6.
Worcester No. 1 cut 0.5c; Nos. 2 and 4, cut 1.5c, Aug. 30.
Hartford No. 1 cut 2c; Nos. 2 and 4 cut 1.5c, June 9.

FUEL OIL

(Continued from page 42)

Industrial fuel demand was reported slightly better in the Chicago area although most of this fuel was shipped from local refineries, according to reports. Michigan lower viscosity fuels were reported tight with demand active from industrial plants.

* * *

NEW YORK, Sept. 6. — Trade attention turned to fuel oils in eastern seaboard markets the week ended Sept. 3.

While there were few changes of consequence in the fuel oil markets generally, thoughts of the coming heating oil season began to supplant the attention of the waning gasoline season. No. 6 oil was offered 10 cents a barrel lower in the New York, Baltimore and Philadelphia districts. Prices of other grades generally were well held, according to reports.

* * *

TULSA, Sept. 6.—Last week marked the beginning of the heating oil season according to some Mid-Continent refiners. For them it meant the accumulation of the first batch of light fuel definitely tagged "heating oil". Others said they had been storing light fuels for several weeks in anticipation of fall demand. Demand from open market buyers the past week was light, however, and shipments against contracts were small, but prices were steady, refiners said.

Heavy oils continued to pile up at Mid-Continent plants as production outdistanced demand, according to reports.

LOUISVILLE, Ky. — Louisville Oil Men's Bowling League will open its season Oct. 4 at the Fifth Avenue Recreation Alleys with ten teams, bowling each Tuesday night at 9 o'clock.

TANK WAGON MARKETS, HEATING OILS

Prices in Effect Sept. 5, 1938

Following are posted tank wagon prices of various grades of heating oil at the points shown in various territories. Prices are in cents per gallon.

	No. 1	No. 2	No. 4
S. O. NEW JERSEY			
Atlantic City, N. J.	8.0	6.0	6.0
Newark	8.0	6.0	6.0
Annapolis, Md.	....	6.25	....
Baltimore	7.0	6.0	5.5
Washington, D. C.	7.25	6.5	6.5
Norfolk, Va.	7.0	6.0	6.0
Petersburg	7.25	6.25	....
Richmond	7.25	6.25	6.25
Charlotte, N. C.	8.75	7.75	....
Hickory	....	8.25	....
Raleigh	8.75	7.25	....
Charleston, S. C.	8.5	7.0	....
Columbia	9.8	8.3	....
Spartanburg	10.7	9.2	....

SOCONY-VACUUM OIL CO. INC.
(S. O. New York Division)

	No. 2	No. 3	No. 4
New York City	6.50	6.50	6.50
Albany, N. Y.	7.00	7.00	6.50
Rochester, N. Y.	7.50	7.50	7.50
Boston, Mass.	6.00	6.00	6.00
Bangor, Me.	7.50	7.50	7.50
Manchester, N. H.	6.50	6.50	6.50
Burlington, Vt.	8.00	8.00	8.00
Hartford, Conn.	6.00	6.00	6.00
New Haven, Conn.	5.25	5.25	5.25
Providence, R. I.	6.00	6.00	6.00

Note: Prices for No. 1 fuel in Socony-Vacuum territory same as for kerosine which see in tank wagon table for various cities; prices change with kerosine.

	No. 1	No. 2	No. 3	No. 4
ATLANTIC REFINING Cont'd				
Philadelphia, Pa.	7.75	6.00	6.00	6.00
Allentown, Pa.	8.50	6.50	6.50	6.50
Wilmington, Del.	7.75	6.00	6.00	6.00
Springfield, Mass.	8.00	6.50	....	6.50
Worcester, Mass.	8.50	6.00	....	6.00
Hartford, Conn.	7.00	6.00	....	6.00
S. O. OHIO				
Columbus Division and Cleveland	7.50	7.50	7.00	....
City of Lima	8.00	8.00	7.00	....
Rest of Ohio	8.00	8.00	7.50	....

Note: S. O. Ohio prices are for full compartment hose dumps, bucket dumps are 0.5c per gallon higher.

S. O. INDIANA
Stanolex Fuel and Furnace Oils

	No. 1 Fuel	Stanolex Furnace
Chicago	(a)6.5	6.5
Indianapolis	...	(b)7.8
Detroit	...	7.1
Milwaukee	8.4	7.7
Minneapolis	7.8	7.8
St. Louis	7.7	7.9
Kansas City	6.8	6.8

(a) For 400 gals. and over; 150 to 399 gals., 7c; 1 to 149 gals., 8c.
(b) Excluding 4c state tax.
Note: Small-lot deliveries of light fuel oils range up to 2c higher than above quotations.

SEABOARD MARKETS, EXPORT AND COASTWISE

All prices on this page are publisher's opinion of open market quotations or sales, for spot shipment (10 to 15 days). In cargo markets, spot shipment is 90 days. Prices in cents per gallon, except heavy fuel oil in dollars per barrel, in tank car lots, f.o.b. refineries or seaboard terminals in districts designated, unless otherwise noted. Federal, state or municipal taxes not included. Prices quoted apply on products made from legally produced crude. Unless otherwise noted, gasoline octane ratings are determined by C.F.R. Motor method, A.S.T.M. D-357-33T; and lubricating oil specifications determined according to A.S.T.M. methods, unless otherwise noted.

Eastern Domestic

(Inter-refinery and export prices not included.)

MOTOR GASOLINE

Prices Effective	Sept. 6	
District:	(a)60-64 Oct.	(a) 65 Oct. & Above
N. Y. harbor	6.25 – 6.75	6.50 – 7.00
(b)N. Y. harbor	6.00 – 6.50	6.25 – 6.75
Philadelphia	6.00 – 6.50	6.00 – 6.50
Baltimore	6.25 – 6.50	6.50 – 6.75
Norfolk	6.75 – 7.00	7.00 – 7.25
Wilmington, N. C.	6.75 – 7.00	7.00 – 7.25
Charleston, S. C.	6.75 – 7.00	7.00 – 7.25
Savannah	7.00 – 7.25	7.25 – 7.50
Jacksonville	7.00 – 7.25	7.25 – 7.50
Portland	7.00 – 7.50	7.25 – 7.75
Boston	6.25 – 7.00	6.50 – 7.00
Providence	6.25 – 7.00	6.50 – 7.00

WATER WHITE KEROSINE

District:			
N. Y. harbor	4.75	Charleston	5.00-5.25
(b)N. Y. harbor	4.625	Savannah	5.25-5.50
Philadelphia	5.00 -5.25	Jacksonville	5.25-5.50
Baltimore	5.00 -5.25	Portland	5.60
Norfolk	5.00 -5.25	Boston	5.00-5.25
Wilmington, N.C.	5.00 -5.25	Providence	5.00-5.25

(c)FUEL OILS

	N. Y. harb.	N. Y. harb. barges
No. 1	4.75	4.625
Nos. 2-3	4.25	4.125
No. 4	4.00 – 4.25	3.875– 4.125
No. 5	(s)$1.15	.....
No. 6	$0.85 –$0.95	.....

	Phila. dist.	Balt. dist.
No. 1	5.00 – 5.25	5.00 – 5.25
Nos. 2-3	4.25	4.25
No. 4	4.00	4.00 – 4.25
No. 5	$1.15	$1.15
No. 6	$0.95	$0.95

	Bost. dist.	Prov. dist.
No. 1	5.00 – 5.25	5.00 – 5.25
Nos. 2-3	4.25	4.25
No. 4	4.00 – 4.25	4.00 – 4.25
No. 5	$1.15	$1.15
No. 6	$0.95	$0.95

District:	(d)Bunker C Fuel	(d)Diesel Oil
N. Y. harbor	(f)$0.95	(g)$1.75
Philadelphia	(f)$0.95	(g)$1.75
Baltimore	(f)$0.95	(g)$1.55
Norfolk	(e)$0.95	$1.75
Charleston	$0.90	$1.75
Savannah	(e)$0.90	$1.785
Jacksonville	(e)$0.90	$1.785
Tampa	(e)$0.85	$1.785
Portland	$1.05	$1.85
Boston	(f)$0.95	(g)$1.75
Providence	$0.95	$1.75

	Gas Oil 28-34 Gravity	Diesel Oil Shore Plants
N. Y. harbor	4.00 – 4.25	4.00 – 4.25
Philadelphia dist.	4.25	....
Baltimore dist.	4.25	....
Norfolk dist.	4.25	....
Savannah dist.	....	4.25
Jacksonville dist.	....	4.25

Pacific Export

(i) (Quotations are at seaboard, Los Angeles, in cargo lots, cents per gal., except where otherwise noted.)

Prices Effective	Sept. 6	Aug. 29
U. S. Motor, under 65 oct.	4.875– 5.00	4.875– 5.00
400 e.p. blend, under 65 oct.	5.00 – 5.125	5.00 – 5.125
400 e.p. blend 65 oct. & above	5.125– 5.375	5.125– 5.375
(h) 38-40 w.w. kerosine	4.25 – 4.75	4.25 – 4.75
41-43 w.w. kerosine	4.75 – 5.00	4.75 – 5.00
44 w.w. kerosine	5.25 – 5.50	5.25 – 5.50
In Cargo lots, per bbl.		
Dieselfuel, 24° & above	$1.05 –$1.15	$1.05 –$1.15
Diesel fuel, under 24°	$0.93 –$1.05	$0.93 –$1.05
(h)30-34 diesel (gas oil)	$1.10 –$1.30	$1.10 –$1.30
(k) Grade C fuel oil	$0.55 –$0.70	$0.55 –$0.70

Prices Effective	Sept. 6	Aug. 29
In Ships' Bunkers, or deep tank lots, per bbl.:		
(j)Diesel fuel oil	$1.525–$1.55	$1.525–$1.55
(k)Grade C fuel oil	$0.70 –$0.90	$0.70 –$0.90
Cased Goods: (Per case)		
U. S. Motor	$1.40 –$1.525	$1.40 –$1.525
400 e.p. blend, under 65 octane	$1.50 –$1.60	$1.50 –$1.60
375–400 e.p. blend, 65 oct. & above	$1.60 –$1.70	$1.60 –$1.70
(h)40-43 w.w. kerosine	$1.30 –$1.40	$1.30 –$1.40
Kerosine, p.w.	$1.25 –$1.35	$1.25 –$1.35

New York Export

(Cents per gal. in bbls. F.a.s. New York)

CYLINDER OILS (Pennsylvania Products)

Prices Effective	Sept. 6	Aug. 29
Bright stock:		
Light, 25 p.t.	21.50	21.50
Neutral oil:		
200 3 color, 25 p.t.	22.50	22.50
150 3 color, 25 p.t.	21.50	21.50
600 s.r., unfiltered	15.50 –16.50	15.50 –16.50
650 s.r., unfiltered	17.50 –18.50	17.50 –18.50
600 fl., s.r.	18.00 –19.00	18.00 –19.00
630 fl., s.r.	20.50 –21.50	20.50 –21.50

Wax, Domestic *and* Export

(A.S.T.M. Tests. Melting points, however, are A.M.P., 3° higher than E.M.P. Export prices, f.a.s., carloads. Domestic prices, f.o.b. refineries in New Orleans & New York districts in bags, carloads, with 0.2c discount allowed for shipment in bulk, except where noted below. Scale solid; fully refined, slabs in bags)

Prices Effective	Sept. 6	
	New York	
	Domestic	Export
124-6 Y.C. scale	2.25 – 2.35	2.25 – 2.35
122-4 W.C. scale	2.25 – 2.35	2.25 – 2.35
124-6 W.C. scale	2.25 – 2.35	2.25 – 2.35
123-5 Fully rfd	3.75	3.375– 3.50
125-7 Fully rfd	3.90	3.50 – 3.625
128-30 Fully rfd	(l)4.00	3.65 – 3.875
130-2 Fully rfd	(l)4.35	4.00 – 4.125
133-5 Fully rfd	(l)4.65	4.40 – 4.625
135-7 Fully rfd	(l)4.90	5.00 – 5.125
	New Orleans	
	Domestic	Export
124-6 Y.C. scale	2.25 – 2.35	2.25 – 2.35
122-4 W.C. scale	2.25 – 2.35	2.25 – 2.35
124-6 W.C. scale	2.25 – 2.35	2.25 – 2.35
123-5 Fully rfd	3.75	3.375– 3.50
125-7 Fully rfd	3.90	3.50 – 3.625
128-30 Fully rfd	(l)4.00	3.65 – 3.875
130-2 Fully rfd	(l)4.35	4.00 – 4.125
133-5 Fully rfd	(l)4.65	4.40 – 4.625

Gulf Coast

(F.o.b. ship, Gulf oil terminals; minimum 20,000 bbls.; representing traders' opinions)

Prices Effective	Sept. 6	Aug. 29
For Domestic shipment:		
MOTOR GASOLINE		
59 oct. & below	4.625– 4.875	4.625– 4.875
60-64 oct.	4.75 – 5.00	4.75 – 5.00
65-67 octane	5.00 – 5.25	5.00 – 5.25
68-70 octane	5.25 – 5.50	5.25 – 5.50
FUEL OILS		
No. 1	3.75 – 4.00	3.75 – 4.00
No. 2	3.50	3.50
KEROSINE		
41-43 w.w.	4.00	4.00
For Export Shipment:		
GASOLINE		
U. S. Motor	4.625– 4.75	4.625– 4.75
60-62, 400 e.p.	4.625– 4.75	4.625– 4.75
61-63, 390 e.p.	4.625– 5.00	4.625– 5.00
64-66, 375 e.p.	4.625– 5.00	4.625– 5.00
KEROSINE		
44 w.w.	(a) 4.25 –4.50	(a)4.25 –4.50
41-43 w.w.	4.00	4.00
41-43 p.w.	4.00	4.00

Prices Effective	Sept. 6	Aug. 29
GAS AND BUNKER OILS		
For Export Shipment		
Gas Oil (m):		
Below 43 diesel index	3.50	3.50
43-47 diesel index	3.50 – 3.625	3.50 – 3.625
48-52 diesel index	(a) 3.50 –3.625	(a) 3.50 –3.625
53-57 diesel index	3.625– 3.75	3.625– 3.75
For Domestic and /or Export Shipment		
Diesel Oil Ship's bkrs.	(o)$1.55	(o)$1.55
Grade C bunker oil for ship's bunkers	(o)$0.75	(o)$0.75
Grade C bunker oil, in cargoes	$0.60 –$0.65	$0.60 –$0.65

MID-CONTINENT LUBRICATING OILS

(Cents per gal. at Gulf; in bbls., f.a.s.; in bulk, f.o.b. terminals)

	Sept. 6	
190-200 vis. D. 210 brt. stock	(p)Barrels 22.50 –24.50	Bulk 17.60 –17.75
150-160 vis. D 210 brt. stock:		
0-10 p.p.	19.00 –20.50	13.00 –14.75
10-25 p.p.	18.50 –20.00	12.50 –14.25
150-160 vis. E 210 brt. stock	18.50 –20.00	13.00 –14.50
120 vis. D 210 brt. stock	18.50 –20.00	13.00 –14.50

	Sept. 6	Aug. 29
180 vis. No. 3 color neutral:	Bulk	Bulk
0-10 p.p.	10.00 –10.50	10.00 –10.50
15-30 p.p.	9.50 –10.00	9.50 –10.00
200 vis. No. 3 color neutral:		
0-10 p.p.	10.00 –10.50	10.00 –10.50
15-30 p.p.	9.50 –10.00	9.50 –10.00
600 s.r. olive green	9.00 –11.25	9.00 –11.25
600 s.r. dark green	7.00 – 9.25	7.00 – 9.25

SOUTH TEXAS LUBRICATING OILS

(Vis. at 100° cold test 0, bulk export shipment, f.o.b. terminals.)

Unfiltered Pale Oils:

Vis.	Color		
100	No. 3	4.75 – 5.00	4.75 – 5.00
200	No. 3	6.25 – 6.75	6.25 – 6.75
300	No. 3	6.75 – 7.25	6.75 – 7.25
500	No. 3½	7.75 – 8.25	7.75 – 8.25
750	No. 4	8.25 – 8.75	8.25 – 8.75
1200	No. 4	8.75 – 9.25	8.75 – 9.25
2000	No. 4	9.00 – 9.50	9.00 – 9.50

Red Oils:

Vis.	Color		
100	No. 5-6	4.75 – 5.00	4.75 – 5.00
200	No. 5-6	6.25 – 6.75	6.25 – 6.75
300	No. 5-6	6.75 – 7.25	6.75 – 7.25
500	No. 5-6	7.75 – 8.25	7.75 – 8.25
750	No. 5-6	8.25 – 8.75	8.25 – 8.75
1200	No. 5-6	8.75 – 9.25	8.75 – 9.25
2000	No. 5-6	9.00 – 9.50	9.00 – 9.50

Note: Red oil prices cover oils with green cast; prices for blue cast red oils are slightly lower in some cases.

Tanker Rates

(Approximate freight rates to Continental ports, shillings per ton of 2240 lbs., British sterling; U. S. ports cents per bbl.)

Rates Effective Sept. 6

	Crude & /or Fuel		Refined Oil & /or Spirits	
	Last Paid	Owners Ask	Last Paid	Owners Ask
Gulf-U.K./Cont.(q)	11/6	12/-12/6	12/	12/6-13/
Aruba-U.K./Cont.(q)	9/3	10/-10/6	10/	10/6-11/
Gulf-N. Atlantic (r) (not E. of N.Y.): Hvy. Crude & fuel, (10 to 19.9 gravity)	17.5c	19c	....	....
Light Crude, (30 Grav. or Lighter)	15c	15-16c	....	....
Gasoline	....	....	15c	16-17c
Kerosine	....	....	15c	16-17c
Light Fuel	....	....	16c	16-17c

(a) Prices nominal. (b) In barge lots. (c) Fuel oils meet specifications of U. S. Commercial Standards CS12-35. (d) In ships' bunkers. (e) For barging, add 5c per bbl. (f) For barging, add 5c to 6c per bbl. (g) For barging, add 6.5c to 7.5c per bbl. (h) 150 fire point. (i) For San Francisco cargo prices, add 5c per bbl. to cargo prices shown above. (j) Pacific Specification 200. (k) Pacific Specification 400. (l) Shipment either in bags or in bulk. (m) Less than ½ of 1% sulfur. (n) No prices reported. (o) Barging 5c per bbl. additional at some Gulf ports. (p) Second-hand barrels. (q) Continental ports in range between Bordeaux and Hamburg, both inclusive. (r) Venezuela loading, same rate; Tampico, 2c to 3c per bbl. additional. (s) Low pour test, low viscosity, No. 5 generally quoted at $1.25.

CRUDE OIL MARKETS

Prices in $ per bbl. of 42 U. S. gals. at the well. A. P. I. gravity. Prices are effective as of 7 a. m. of dates as given

EASTERN FIELDS

Posted by Joseph Seep Purchasing Agency

(Effective Sept. 1, 1938, except Corning Sept. 3, 1938)

Penna. Grade Oil in Southwest Penna. Pipe Lines.....$1.34
Penna. Grade Oil in Eureka Pipe Lines (West Virginia).....$1.28
Penna. Grade Oil in Buckeye Pipe Lines (Macksburg, O.).....$1.18
Corning Oil in Buckeye Pipe Lines (Ohio)...$1.07

Posted by Other Companies

Tide Water Associated Oil Co.
Bradford-Allegany district (Penna. and N. Y.) (Effective Sept. 1, 1938).....$1.68
*The Pennzoil Co.: (Effective Sept. 1, 1938)
Penna. Grade Oil in National Transit Lines*$1.61
Ashland Oil & Transportation Co.:
Somerset Oil in Ashland Lines (Ky.):

(Effective July 1, 1938)

Big Sandy River.....$1.32
Kentucky River.....$1.40

*The Pennzoil Co. posts $1.61 in Cochran, Franklin, Hamilton and Doolittle, Pa. fields; prices in other lower districts range down to $1.56 per bbl. at well.

MICHIGAN

Posted by Pure Oil Co.

Midland, Midland County (Jan. 5, 1938)....$1.12

Posted by Simrall Corp.

(Effective Aug. 9, 1938)
West Branch, Arenac, and equal grades.....$0.90

(Effective Jan. 8, 1938)

Allegan, Crystal, Greendale, Porter and equal grades.....$1.12
Beaverton, Buckeye, Bentley, Edenville and Freeman.....$1.095

CENTRAL STATES FIELDS

Posted by Ohio Oil Co.

(Effective Jan. 28, 1937)
Illinois, Princeton.....$1.35

(Effective June 22, 1938)
Owensboro, (Western Ky.).....$1.30

(Effective Nov. 20, 1937)
Lima, O.....$1.00

Posted by Owensboro Corp.

(Effective May 25, 1938)
North Centralia, Ill.....$1.25

(Effective Aug. 8, 1938)
Centralia, Ill. (congested area).....$1.10

Posted by Stoll Oil Refining Co.

(Effective June 22, 1938)
Stoll Pipe Line Oil (Ky.).....$1.30

CANADIAN FIELDS

Posted by Imperial Oil Limited

Western Ontario

(Effective Sept. 9, 1933)

Petrolia.....$2.10
Oil Springs.....$2.17

Alberta—Turner Valley

(Prices f.o.b. field tankage)
(Effective Jan. 5, 1938)

Crude Oil			
40-40.9*.....	$1.14	53-53.9.....	$1.40
41-41.9.....	1.16	54-54.9.....	1.42
42-42.9.....	1.18	55-55.9.....	1.44
43-43.9.....	1.20	56-56.9.....	1.46
44-44.9.....	1.22	57-57.9.....	1.48
45-45.9.....	1.24	58-58.9.....	1.50
46-46.9.....	1.26	59-59.9.....	1.52
47-47.9.....	1.28	60-60.9.....	1.54
48-48.9.....	1.30	61-61.9.....	1.56
49-49.9.....	1.32	62-62.9.....	1.58
50-50.9.....	1.34	63-63.9.....	1.60
51-51.9.....	1.36	64-64.9.....	1.62
52-52.9.....	1.38		

Crude Naphtha, 65 grav. & above.....$2.14

Absorption Gasoline

90% Rec., 20 lb. Reid v.p.....$1.94
90% Rec., 17 lb. Reid v.p.....$2.08

†MID-CONTINENT

(Effective Jan. 28, 1937)

	(In Oklahoma- *Kansas)	(In North-North Central Texas)
Below 29.....	$1.06	$0.96
29-29.9.....	1.08	0.98
30-30.9.....	1.10	1.00
31-31.9.....	1.12	1.02
32-32.9.....	1.14	1.04
33-33.9.....	1.16	1.06
34-34.9.....	1.18	1.08
35-35.9.....	1.20	1.10
36-36.9.....	1.22	1.12
37-37.9.....	1.24	1.14
38-38.9.....	1.26	1.16
39-39.9.....	1.28	1.18
40 & above....	1.30	1.20

†Prices posted by Standard Oil Co. (Indiana) in Okla.-Kans., and in Texas by Stanolind Oil Purchasing Co.

Above prices met as follows:

Jan. 28, Continental Oil Co. met in Okla., Kans., and North Texas. Sinclair-Prairie met in North Texas and North Central Texas, Jan. 28, Stanolind's North Texas schedule. Same date, The Texas Co. met in North-North Central Texas.

Effective June 16, 1938, Kanotex Refg. Co. posted Okla.-Kans. crude, 34 & below, at $1.03, 35-35.9 at $1.05, plus 2c differential to 40 & above, at $1.15.

Effective Sept. 1, 1938, Rock Island Oil Co. cut southern Okla. crude, in Stephens, Carter and Garvin counties, 10c, posting 20-20.9 at $0.65, plus 4c differential to 25-25.9 inclusive; from 26-26.9 to 30-30.9 inclusive, 3c differential; and from 31-31.9 to 40 and above, 2c differential, with 40 & above being $1.20.

Note: S. O. Indiana prices in Okla.-Kans. are for quantities computed by 97% tank tables. In Texas, 100% tank tables are used effective Oct. 1, 1937, volume corrected to 60° F., and deduction for full b.s. & w. content.

*Effective Aug. 1, 1937, for Otis-Albert pools Rush-Barton counties, Kans., 13c less.

Posted by Carter Oil Co.

In Oklahoma

(Effective Jan. 28, 1937)

Below 25.....$0.98		33-33.9.....$1.16	
25-25.9.....	1.00	34-34.9.....	1.18
26-26.9.....	1.02	35-35.9.....	1.20
27-27.9.....	1.04	36-36.9.....	1.22
28-28.9.....	1.06	37-37.9.....	1.24
29-29.9.....	1.08	38-38.9.....	1.26
30-30.9.....	1.10	39-39.9.....	1.28
31-31.9.....	1.12	40 and above...	1.30
32-32.9.....	1.14		

Above Carter schedule met Jan. 28 by the following companies: Sinclair-Prairie, Shell and Barnsdall in Oklahoma-Kansas; Skelly Oil in Kansas; Tide Water in Oklahoma; Pure Oil in Oklahoma-Kansas, beginning with below 24 at $0.98 and ending with 40 & above at $1.30.

Posted by Magnolia Petroleum Co.

(Effective Jan. 28, 1937)

In Oklahoma, same schedule as Carter Oil, which see above, beginning with below 25, at $0.98 and ending with 40 & above, at $1.30.

In Texas: North and North Central, including Burkburnett, Archer, Henrietta, Electra, Comanche and Olden, same gravity and price schedule as Stanolind in North Texas, which see under Stanolind, beginning with below 29 at $0.96 and ending with 40 and above, at $1.20.

	Jefferson County, Beaumont (Magnolia) (Oct. 1, 1937)	Texas West Beaumont (Humble) (May 1, 1938)
Below 21°.....	$0.95	$0.95
21-21.9.....	0.98	0.98
22-22.9.....	1.01	1.01
23-23.9.....	1.04	1.04
24-24.9.....	1.07	1.07
25-25.9.....	1.10	1.10
26-26.9.....	1.13	1.13
27-27.9.....	1.15	1.15
28-28.9.....	1.17	1.17
29-29.9.....	1.19	1.19
30-30.9.....	1.21	1.21
31-31.9.....	1.23	1.23
32-32.9.....	1.25	1.25
33-33.9.....	1.27	1.27
34-34.9.....	1.29	1.29
35-35.9.....	for	1.31
36-36.9.....	oil	1.33
37-37.9.....	34 & above	1.35
38-38.9.....		1.37
39-39.9.....		1.39
40 & above....		1.41

TEXAS FIELDS

Posted by Humble Oil & Refining Co.

*(*West Central Texas)*

(Effective Aug. 29, 1938)

28-28.9.....$0.96		37-37.9.....$1.14	
29-29.9.....	0.98	38-38.9.....	1.16
30-30.9.....	1.00	39-39.9.....	1.18
31-31.9.....	1.02	40-40.9.....	1.20
32-32.9.....	1.04	41-41.9.....	1.22
33-33.9.....	1.06	42-42.9.....	1.24
34-34.9.....	1.08	43-43.9.....	1.26
35-35.9.....	1.10	44-44.9.....	1.28
36-36.9.....	1.12	45 & above.....	1.30

*Includes Brown, Callahan, Coleman, Comanche, Eastland, Fisher, Haskell, Jones, Shackelford, Stephens, Throckmorton and Young counties.

Note: Effective Oct. 1, 1937, Humble prices are based on 100% tank tables at 60F.

East Central Texas

(Effective Jan. 28, 1937)

Below 29.....$1.03		35-35.9.....$1.17	
29-29.9.....	1.05	36-36.9.....	1.19
30-30.9.....	1.07	37-37.9.....	1.21
31-31.9.....	1.09	38-38.9.....	1.23
32-32.9.....	1.11	39-39.9.....	1.25
33-33.9.....	1.13	40 and above...	1.27
34-34.9.....	1.15		

*Including Anderson, Cherokee, Limestone, Navarro counties.

Same date, Sinclair-Prairie met in Mexia Humble's above schedule.

PANHANDLE TEXAS

Posted by Humble Oil & Refining Co.

	Gray County	Carson-Hutchinson
(Effective Aug. 29, 1938)		
34-34.9.....	$0.96	$0.91
35-35.9.....	0.98	0.93
36-36.9.....	1.00	0.95
37-37.9.....	1.02	0.97
38-38.9.....	1.04	0.99
39-39.9.....	1.06	1.01
40-40.9.....	1.08	1.03
41-41.9.....	1.10	1.05
42-42.9.....	1.12	1.07
43-43.9.....	1.14	1.09
44-44.9.....	1.16	1.11
45 & above.....	1.18	1.13

EAST TEXAS

(Effective *Aug. 29-30-Sept. 1, 1938)

Gulf, Humble, Magnolia, Shell, Sinclair-Prairie, Stanolind, Sun, Texas Co., Tide-Water Associated $1.25

*Effective Aug. 29 by Gulf, Humble, Shell, Stanolind; Aug. 30 by Sinclair-Prairie, Texas, Tide Water; Sept. 1, Magnolia and Sun.

Shell also posted on Jan. 28, in Livingston area, Polk County, Texas, $1.27.

NORTHEAST TEXAS

(Posted by Humble, Jan. 28, 1937)

Talco.....$0.73

(Posted by Magnolia, Jan. 28, 1937)

Cass County and Panola County, Tex.: Same gravity and price schedule as S. O. Louisiana posts for Rodessa, La., which see under that company

(Posted by The Texas Co., Jan. 28, 1937)

Cass County.....$1.25

WEST TEXAS AND NEW MEXICO

Posted by Humble Oil & Refining Co.

(Effective Jan. 28, 1937)

(Including Andrews, Crane, Crockett, Ector, *Gaines, Glasscock, Howard, *Reagan, Upton, Winkler and *Yoakum Counties, Texas and Lea county, New Mexico).

Below 26.....$0.78		33-33.9.....$0.94	
26-26.9.....	0.80	34-34.9.....	0.96
27-27.9.....	0.82	35-35.9.....	0.98
28-28.9.....	0.84	36-36.9.....	1.00
29-29.9.....	0.86	37-37.9.....	1.02
30-30.9.....	0.88	38-38.9.....	1.04
31-31.9.....	0.90	39-39.9.....	1.06
32-32.9.....	0.92	40 & above.....	1.08

Pecos, West Texas.....$0.91

*Added to this posting, Aug. 29, 1938.

Jan. 28, Magnolia met Humble in Crane, Upton, Howard, Glasscock, Mitchell and Winkler.

Shell Petroleum Corp., on Jan. 28, met Humble in Crane, Glasscock, Howard, Pecos (except Yates shallow pool), Winkler, and Upton counties, Tex., and in Lea County, N. Mex. On Jan. 28, Shell posted in Yates shallow pool in Pecos county, Tex., $0.81. June 4, 1937, Shell added Ector county to West Texas postings.

Jan. 28, Stanolind Oil Purchasing Co. met Humble in Hendrick field, Winkler county.

Jan. 28, Texas Co. met Humble in Ward and Winkler counties, Tex., and Lea County, N. M. except that its top grade is 36 and above, at $1.00.

April 20, 1937, Sinclair Prairie met Humble in Ward and Winkler, Tex. and Lea, N. M., counties, except that its gravity schedule ends with 36 and above, at $1.00.

Posted by Continental Oil Co.

(Effective Jan. 28, 1937)

Artesia, Jackson and Maljamar pools, N. M...$0.90

COLORADO

(Posted by Continental Oil Co.)

(Effective Jan. 28, 1937)

	Ft. Collins and Wellington		
Below 29.....$1.01		35-35.9.....$1.15	
29-29.9.....	1.03	36-36.9.....	1.17
30-30.9.....	1.05	37-37.9.....	1.19
31-31.9.....	1.07	38-38.9.....	1.21
32-32.9.....	1.09	39-39.9.....	1.23
33-33.9.....	1.11	40 & above.....	1.25
34-34.9.....	1.13		

Canon City and Florence, Col.....$1.10

SOUTH AND SOUTHWEST TEXAS

All Shown Below Posted by Humble Oil & Refining Co.

(Effective Jan. 28, 1937)

Carroll, Clark, Darst Creek, Hilbig, Salt Flat and Zoboroski fields.....$1.09
Van Zandt.....$1.10

(Effective Aug. 29, 1938)

Flour Bluff.....$1.40
Pettus.....1.42

Jan. 28, Magnolia met Humble in Darst Creek; posted $1.00 in Luling; $1.12 in Lytton Springs; $1.27 for Cleveland, and $1.15 in Hardin, both in Liberty county, Tex. Effective July 11, 1938, Sun Oil Co. posted $1.15 for Hardin.

Jan. 28, 1937, The Texas Co. met Humble in Darst Creek.

Anahuac, Cedar Point, Dickinson, Gillock, Fairbanks, and Turtlebay

(Effective Aug. 29, 1938)

27-27.9.....$1.10		39-39.9.....$1.34	
28-28.9.....	1.12	40-40.9.....	1.36
29-29.9.....	1.14	41-41.9.....	1.38
30-30.9.....	1.16	42-42.9.....	1.40
31-31.9.....	1.18	43-43.9.....	1.42
32-32.9.....	1.20	44-44.9.....	1.44
33-33.9.....	1.22	45-45.9.....	1.46
34-34.9.....	1.24	46-46.9.....	1.48
35-35.9.....	1.26	47-47.9.....	1.50
36-36.9.....	1.28	48-48.9.....	1.52
37-37.9.....	1.30	49-49.9.....	1.54
38-38.9.....	1.32	50 & above.....	1.56

Conroe, Raccoon Bend (Deep sand crude) Tomball and Satsuma

(Effective Aug. 29, 1938)

28-28.9.....$1.20		37-37.9.....$1.38	
29-29.9.....	1.22	38-38.9.....	1.40
30-30.9.....	1.24	39-39.9.....	1.42
31-31.9.....	1.26	40-40.9.....	1.44
32-32.9.....	1.28	41-41.9.....	1.46
33-33.9.....	1.30	42-42.9.....	1.48
34-34.9.....	1.32	43-43.9.....	1.50
35-35.9.....	1.34	44-44.9.....	1.52
36-36.9.....	1.36	45 & above.....	1.54

Jefferson County, Tex.

West Beaumont, see prices under Magnolia in center column.

(Continued on next page)

CRUDE OIL MARKETS (*Continued from preceding page*)

South-Southwest Texas (cont'd)

Posted by Humble

***Mirando**

(Effective Aug. 29, 1938)

20-20.9	$0.96	36-36.9	$1.28
21-21.9	0.98	37-37.9	1.30
22-22.9	1.00	38-38.9	1.32
23-23.9	1.02	39-39.9	1.34
24-24.9	1.04	40-40.9	1.36
25-25.9	1.06	41-41.9	1.38
26-26.9	1.08	42-42.9	1.40
27-27.9	1.10	43-43.9	1.42
28-28.9	1.12	44-44.9	1.44
29-29.9	1.14	45-45.9	1.46
30-30.9	1.16	46-46.9	1.48
31-31.9	1.18	47-47.9	1.50
32-32.9	1.20	48-48.9	1.52
33-33.9	1.22	49-49.9	1.54
34-34.9	1.24	50 & above	1.56
35-35.9	1.26		

*Includes Duval, Jim Hogg, Jim Wells, Webb and Zapata counties, Tex. and Heyser and Placedo crudes.

July 6, 1937, Texas Co. posted for Duval-Mirando, $0.96 for below 21, plus 2c differential, to $1.12 for 28 & above.

LOUISIANA-ARKANSAS

Posted by Standard Oil Co. of Louisiana

(Effective Jan. 28, 1937)

Gravity	*N. La.-Ark.	Rodessa, La.	Roanoke & N. Crowley, S. La. (Dec. 28, '37)	†Columbia County, Ark. (July 7, 1938)
Below 21°.	$0.90	$0.93	$0.90	$0.83
21-21.9	for	for	.93	for
22-22.9	oil	oil	.96	oil
23-23.9	Below	Below	.99	Below
24-24.9	25°	25°	1.02	25°
25-25.9	$0.92	$0.95	1.05	$0.85
26-26.9	.94	.97	1.08	.87
27-27.9	.96	.99	1.10	.89
28-28.9	.98	1.01	1.12	.91
29-29.9	1.00	1.03	1.14	.93
30-30.9	1.02	1.05	1.16	.95
31-31.9	1.04	1.07	1.18	.97
32-32.9	1.06	1.09	1.20	.99
33-33.9	1.08	1.11	1.22	1.01
34-34.9	1.10	1.13	1.24	1.03
35-35.9	1.12	1.15	1.26	1.05
36-36.9	1.14	1.17	1.28	1.07
37-37.9	1.16	1.19	1.30	1.09
38-38.9	1.18	1.21	1.32	1.11
39-39.9	1.20	1.23	1.34	1.13
40 & above	1.22	1.25	1.36	1.15

*Includes Caddo, Homer, Haynesville, Sabine, De Soto, Sarepta, Carterville, El Dorado, Bunkie and Miller county.

†Includes Buckner, Magnolia, and Village pools.

Smackover, Ark. $0.90

Urania, La. (Ark. Fuel Oil Co., Jan. 28 '37). $1.02

(Posted by Continental Oil Co.)

*Tepetate, *Abbeville and *Ville Platte, La. $1.24

*Tepetate effective Jan. 28, 1937; Abbeville and Ville Platte, June 1, 1938.

Jan. 28, 1937, Magnolia posted in Pine Island, Haynesville, Bull Bayou and Cotton Valley, La., Eldorado and Rainbow districts, Ark. same price and gravity schedule as S. O. La. posts in N. La.-Ark. fields; and met S. O. La's. Rodessa prices; and in Lockport, Iowa, Cameron Meadow, La., posted same gravity and price schedule as Humble posts on Mirando, Tex. crude. El Dorado East Field, Ark. price same as Smackover, effective Jan. 28, '37.

Jan. 28, The Texas Co. met S. O. La. in N. La., except that its gravity schedule begins with below 27 at $0.94. It posted $1.37 for Garden Island, La., $1.24 for LaFitte, La. and $0.90 for Smackover.

***GULF COASTAL FIELDS**

Posted by Humble Oil & Refining Co. and The Texas Co.

	(Effective Jan. 28, 1937 Humble	Texas	†Refugio Saxet, etc. (Humble) (Aug. 29,'38)
Below 18..	$0.95	*$0.95	....
18-18.9....	for	for	....
19-19.9....	below	below	....
20-20.9....	21°	21°	$1.01
21-21.9....	0.98	0.98	1.03
22-22.9....	1.01	1.01	1.05
23-23.9....	1.04	1.04	1.07
24-24.9....	1.07	1.07	1.09
25-25.9....	1.10	1.10	1.11
26-26.9....	1.13	1.13	1.13
27-27.9....	1.15	1.15	1.15
28-28.9....	1.17	1.17	1.17
29-29.9....	1.19	1.19	1.19
30-30.9....	1.21	1.21	1.21
31-31.9....	1.23	1.23	1.23
32-32.9....	1.25	1.25	1.25
33-33.9....	1.27	1.27	1.27
34-34.9....	1.29	1.29	1.29
35-35.9....	1.31	for	1.31
36-36.9....	1.33	oil	1.33
37-37.9....	1.35	34°	1.35
38-38.9....	1.37	and	1.37
39-39.9....	1.39	above.	1.39
40-40.9....	1.41	....	1.41
41-41.9....	for	....	1.43
42-42.9....	oil	....	1.45
43-43.9....	40°	....	1.47
44-44.9....	and	....	1.49
45-45.9....	above.	....	1.51
46-46.9....	....	....	1.53
47-47.9....	....	....	1.55
48-48.9....	....	....	1.57
49-49.9....	....	....	1.59
50 & above.	....	....	1.61

†Includes also Greta, O'Connor-McFadden, Taft, Plymouth and Tom O'Connor crudes.

*Humble's prices apply in these Texas fields: Amelia, Barbers Hill, Clear Lake (beginning Aug. 29, 1938), Clinton, Goose Creek, Hull, Liberty, Mykawa, Orange, Pierce Junction, Raccoon Bend, (shallow sand), Sugarland, Thompsons, Webster, (beginning Aug. 29, 1938), and West Columbia. Same prices also apply, effective Feb. 1, 1938, in Clinton, Tex., posted by Stanolind.

Jan. 28, Sinclair-Prairie met above Humble schedule in full

‡$0.95 for oil below 21° posted April 1, 1938.

July 6, 1937, The Texas Co. posted for Refugio, which includes Greta, Saxet and Taft: $1.01 for below 21, plus 2c differential, to $1.17 for 28 & above.

Texas Co. postings in Gulf Coastal Texas include: Arriola, Five Corners, Ganado, Humble, Liberty, Magnet, Manvel, Markham, Mauritz, McFaddin, Pickett Ridge, Port Neches, Sour Lake, West Columbia and Withers. In Gulf Coastal Louisiana: Bay St. Elaine, Caillou Island, Dog Lake, Four Isle, Gillis, Horseshoe Bayou, Iberia, Lake Barre, Lake Pelto, Leeaville and Port Barre.

ROCKY MOUNTAIN FIELDS

Posted by Stanolind Oil & Gas Co.

(Effective Jan. 28, 1937)

Salt Creek, (except Tensleep crude), Midway and Dutton Creek, Wyo., same schedule as Stanolind posts in Oklahoma, Kansas which see under Mid-Continent crude on previous page.

(Effective Jan. 6, 1938)

Tensleep, Salt Creek field $0.70

(Effective Jan. 28, 1937)

Greybull-Torchlight $1.30
Iles, light, Col. 1.18
Iles, heavy 1.12
Hogback, N. M. 1.33
Big Muddy 1.23

(Effective July 8, 1938)

Elk Basin, light $1.05
Grass Creek, light 1.05

(Effective May 1, 1938)

Frannie light $0.65
Grass Creek, heavy 0.50
Hamilton Dome, Wyo. 0.45

(Effective Nov. 4, 1936)

Frannie heavy $0.62

Posted by Ohio Oil Co.

(Effective July 8, 1938)

Elk Basin, Wyo. $1.05
Grass Creek, light 1.05

(Effective Jan. 28, 1937)

Rock Creek 1 205
Lance Creek 0.97

(Effective May 1, 1938)

Grass Creek heavy $0.50

(Effective Nov. 16, 1937)

Sunburst, Mont. $0.90

Posted by Continental Oil Co.

(Effective Jan. 1, 1938)

Cat Creek, Mont. $1.30

(Effective Jan. 28, 1937)

Big Muddy, Wyo. $1.18
Lance Creek, Wyo. 0.97

CALIFORNIA, *Posted by Standard Oil of California*

All gravities above those quoted take highest price offered in the field. Prices effective Feb. 26, 1936, except Huntington Beach, Playa del Rey, Santa Fe Springs, Kern Front, Signal Hill (Long Beach) effective March 7, 1936; Elk Hills effective June 22, 1936; Lakeview Area, Aug. 19, 1936; El Segundo and Wilmington, Oct. 15, 1937; Greeley-Canal, July 9, 1938; Santa Maria Valley, by Union Oil, May 20, 1938.

Gravity	Signal Hill (Long Beach) El Segundo †Wilmington	Seal Beach	Alamitos Heights	Huntington Beach	Inglewood	Playa del Rey	Olinda Brea Canon	Athens Rosecrans	Domingues	Torrance	Richfield	Whittier East Coyote (La Habra)	Montebello	West Coyote Hills	Santa Fe Springs	‡Newhall and others	Mountain View	Elk Hills	Buena Vista Hills Midway-Sunset Lakeview Area	Greeley-Canal (Kern County)	Lost Hills	Coalinga	Wheeler Ridge	Santa Maria (Union Oil)
13-13.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	$0.40
14-14.9	$0.80	$0.79	$0.74	$0.78	$0.79	$0.80	$0.76	....	....	$0.80	$0.76	$0.76	$0.77	$0.78	....	$0.70	....	$0.70	$0.70	....	$0.70	$0.70	....	.42
15-15.9	.80	.79	.74	.78	.79	.80	.76	....	....	.80	.76	.76	.77	.78	....	.70	....	.70	.70	....	.70	.70	....	.44
16-16.9	.80	.79	.74	.78	.79	.80	.76	....	....	.80	.76	.76	.77	.78	....	.70	....	.70	.70	....	.70	.70	....	.45
17-17.9	.80	.79	.74	.78	.81	.80	.76	....	....	.80	.76	.76	.77	.78	....	.70	....	.70	.70	....	.70	.70	....	.46
18-18.9	.80	.79	.74	.78	.84	.80	.78	....	....	.82	.76	.76	.77	.78	....	.70	....	.70	.70	....	.70	.70	....	.47
19-19.9	.82	.79	.74	.82	.87	.84	.81	....	....	.85	.76	.78	.77	.78	....	.70	.70	.74	.74	....	.74	.71	.70	.48
20-20.9	.85	.79	.74	.85	.90	.88	.84	....	....	.88	.78	.82	.77	.80	....	....	.70	.78	.78	....	.78	.72	.70	....
21-21.9	.88	.79	.74	.89	.93	.93	.88	....	....	.91	.80	.85	.77	.84	.78	....	.73	.82	.82	....	.82	.74	.70	....
22-22.9	.92	.82	.74	.92	.96	.98	.92	....	....	.93	.84	.89	.79	.88	.78	....	.77	.87	.87	....	.86	.78	.72	....
23-23.9	.95	.86	.77	.96	.99	1.02	.96	.84	.79	.96	.88	.93	.82	.92	.78	....	.80	.92	.92	....	.90	.82	.76	....
24-24.9	.99	.91	.80	1.00	1.02	1.06	.99	.88	.81	.99	.91	.96	.85	.96	.82	....	.84	.97	.97	....	.94	.86	.79	....
25-25.9	1.03	.95	.82	1.03	1.05	1.11	1.03	.93	.83	1.02	.95	....	.89	.99	.86	....	.88	1.01	1.01	....	.98	.90	.83	....
26-26.9	1.06	1.00	.85	1.07	1.09	1.16	1.06	.98	.86	1.05	.98	....	.92	1.03	.90	....	.91	1.06	1.06	....	1.02	....	....	....
27-27.9	1.10	1.05	.88	1.11	1.12	....	1.10	1.03	.88	....	1.02	....	.96	1.06	.95	....	.95	1.10	1.10	$0.91	1.06	....	....	....
28-28.9	1.14	1.10	.90	1.14	1.15	....	1.14	1.07	.90	....	1.06	....	.99	1.10	.99	....	.99	1.15	1.15	.94	1.10	....	....	....
29-29.9	1.17	1.15	.93	1.18	1.18	....	1.17	1.12	.93	....	1.09	....	1.03	1.14	1.03	....	1.02	1.20	1.20	.98	1.14	....	....	....
30-30.9	1.21	1.19	.95	1.22	1.21	....	1.21	1.17	.95	....	....	....	1.07	1.17	1.08	....	1.06	1.25	1.25	1.02	1.18	....	....	....
31-31.9	....	....	....	....	1.24	....	1.24	1.22	.97	....	....	....	1.11	1.21	1.12	....	1.09	1.29	1.29	1.06	....	....	....	....
32-32.9	*Elwood Terrace			....	1.27	....	1.27	1.27	1.00	....	....	....	1.14	1.25	1.16	....	1.13	1.34	1.34	1.09	Kettleman Hills			....
33-33.9	....	1.28	....	....	....	....	....	1.32	....	....	....	....	1.18	1.28	1.20	....	1.17	1.38	1.38	1.13	....	1.19	....	....
34-34.9	....	1.32	....	....	....	....	....	1.37	....	....	....	....	1.22	1.32	1.25	....	1.20	....	....	1.17	....	1.23	....	....
35-35.9	....	1.35	....	....	....	....	....	1.42	....	....	....	....	1.25	....	1.29	....	....	....	....	1.20	....	1.27	....	....
36-36.9	....	1.39	....	....	....	....	....	1.46	....	....	....	....	1.29	....	1.33	....	....	....	....	1.24	....	1.31	....	....
37-37.9	....	1.43	....	....	....	....	....	1.51	....	....	....	....	1.32	....	1.37	....	....	....	....	1.28	....	1.35	....	....
38-38.9	....	....	....	....	....	....	....	1.56	....	....	....	....	1.36	....	1.42	....	....	....	....	1.31	....	1.39	....	....
39-39.9	....	....	....	....	....	F. O. B. Standard Pipe Line	....	1.61	....	....	....	....	1.40	....	....	....	....	....	....	1.35	....	1.43	....	....
40-40.9	....	....	....	....	....		....	1.66	....	....	....	....	1.43	....	....	....	....	....	....	1.39	....	....	....	....
41-41.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.43	....	....	....	....
42-42.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.46	....	....	....	....
43-43.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.50	....	....	....	....
44-44.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.54	....	....	....	....
45-45.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.57	....	....	....	....
46-46.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.61	....	....	....	....
47-47.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.65	....	....	....	....
48-48.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.68	....	....	....	....

*F. o. b. ship.

‡Also McKittrick, Kern River. Kern Front and Round Mountain $0.70 thru 19.9 gravity; no higher gravity quoted.

†Wilmington prices differ on gravities below 18.9. Prices are: 14-16.9, $0.75; 17-17.9, $0.77; and 18-18.9, $0.79; rest of schedule same as Signal Hill.

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Capacity 600,000 gallons.

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Coming Meetings

National Petroleum Assn., 36th annual meeting, Hotel Traymore, Atlantic City, Sept. 14, 15 and 16.
Oil Trades Assn. of New York, sports day, Pelham Country Club, Pelham, N. Y., Sept. 20.
Gasoline Pump Manufacturers Assn., Code Anniversary Meeting, Dearborn Inn., Dearborn, Mich., Sept. 20, 21.
Michigan Petroleum Assn., Park Place Hotel, Traverse City, Mich., Sept. 22, 23.
National Association of Petroleum Retailers, annual meeting, St. Louis, Sept. 27, 28 and 29.
American Assn. of Petroleum Geologists, mid-year meeting, under direction of West Texas Geological Society, El Paso, Tex., Sept. 27-Oct. 2.
National Assn. of Credit Men, Southwest Credit Conference, San Antonio, Tex., some time in Oct.
National Lubricating Grease Institute, 6th annual meeting, Chicago, Oct. 3 and 4.
Ohio Petroleum Marketers Assn., fall conference and golf tournament, Ohio Hotel and Southern Hills Country Club, Youngstown, O., Oct. 5, 6.
American Institute of Mining and Metallurgical Engineers, Petroleum Division, Plaza Hotel, San Antonio, Tex., Oct. 5-7.
New England States Tax Officials Assn., 26th annual conference, Bangor, Me., Oct. 6, 7.
Society of Automotive Engineers, national regional fuels and lubricants meeting, Tulsa, Okla., Oct. 6 and 7.
Montana National Bituminous Conference, sponsored by Western Petr. Refiners Assn. and Mont. and Miss. highway departments, Edgewater Gulf Hotel, Biloxi, Miss., Oct. 10 to 13.
American Gas Assn., Atlantic City, N. J., Oct. 10 to 14.
National Safety Congress, Petroleum Section, Hotel Stevens, Chicago, Ill., Oct. 10 to 14.
North American Gasoline Tax Conference, Tulsa, Oct. 10 to 14.

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H. S. Barnes

H. S. Barnes of Fort Worth, credit manager for Continental Oil Co.'s southwest district, is president of the recently organized Southwest Petroleum Credit Group, which embraces credit men for oil companies in Arkansas, Louisiana, Oklahoma, New Mexico and Texas. It is affiliated with the National Association of Creditmen and the National Retail Credit Association.

Mr. Barnes has been in the southwest division of the Continental for eight years and before that was for several years with its Colorado division.